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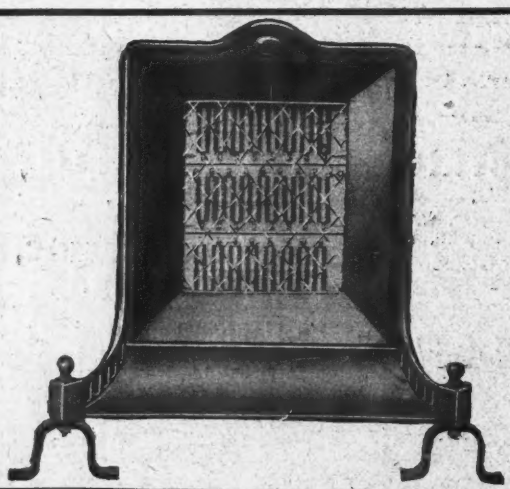

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BRITISH CANALS.

IN our last issue we drew attention to the announcement that the Government had decided to take control of the internal waterways of this country, together with all buildings and plant connected therewith, and to appoint a committee to take charge of this means of transportation. The Government, having already assumed control of all the railways and shipping of the United Kingdom, thus becomes the sole authority for the carriage of munitions and merchandise by land or water, the only remaining alternative being transport by road, which is practically unorganised, and too costly at the present time to play an important part in the matter. The fact that the Government control applies only "for the period of the war" constitutes an element of uncertainty which is to be regretted. Whatever the merits or demerits of State control or ownership—for which in normal times we have no liking—the conditions obtaining in connection with our internal navigations are so deplorably chaotic that, we must confess, the only possible avenue for escape from the present lamentable waste of traffic facilities appears to be centralisation of control, the way to which has been unexpectedly thrown open by the war. It will be remembered that the Royal Commission on Canals and Waterways, which sat from 1906 to 1909, recommended in the latter year that a central "Waterway Board" should be constituted for Great Britain, and that the four main arteries, known as the "Cross," should be put under its control without delay and unified. Those waterways would have been "improved to the 100-ton standard" as a minimum, though some parts of them could be traversed by very much heavier vessels, and would have given excellent communication by water between the great Midland cities and the Thames, Humber, Mersey, and Severn rivers.

The system under existing conditions in 1905 conveyed a traffic (including the Birmingham Canal) of 16.6 million tons, possessed a mileage of 1,084 miles, and earned a net revenue of £228,691. The total cost of the necessary improvements on this system, with its branches, was estimated at 17.5 millions sterling, and the annual expenditure at 1.1 millions, which could have been covered with about double the traffic actually recorded. The carrying capacity of the 100-ton portions of the routes would have been about five times as great as that of the existing barge canals, and ten times that of the narrow sections, which impede traffic even on these routes, while great economies in time and labour would have been effected. With the adoption of electric haulage, trains of barges carrying 300 tons could have been conveyed, with further saving in cost per ton, but the Commission made no direct recommendation on this subject. While it was impossible to make an accurate forecast as to the traffic eventually obtainable, when the total lack of organisation which existed gave way to a proper system, the Commission pointed out that the Manchester Ship Canal, though then unable to show a working profit, had conferred "remarkable and unquestionable benefit" upon Manchester and the

surrounding district, which had abundantly justified the great outlay incurred. (Incidentally, we may remark that the traffic on that canal has since developed to such an enormous extent that it is now paying dividends on the ordinary shares.)

But what was the result of the Commission's three years' labours? Its final report, a mine of information regarding the waterways of the country from every aspect of the question, was absolutely ignored by the Government of the day, whose time was too much occupied with party politics to permit of its taking into consideration schemes for the assistance and development of industry and commerce, and the subject has been kept alive only by a small but devoted band of believers in the great possibilities of our waterways, of whom Mr. Neville Chamberlain was one of the leaders. So long as the canals are in the hands of private owners, it is impossible to look for any material reform. It will be remembered that, in giving evidence before the Advisory Committee of the Board of Trade with regard to British trade after the war, the B.E.A.M.A. ascribed the cheaper rates for carriage prevailing in Germany, so detrimental to our export trade, partly to the throttling of our canals by railway companies, and to the great development of water transport in recent years in Germany, Holland, and France.

It is true that in certain cases, such as the Aire and Calder, the Weaver, and the North Stafford Navigations, excellent results have been obtained, but these are isolated examples, and the reorganisation and improvement of our waterways in general cannot be dealt with except by one central body charged with their unification and administration on a comprehensive scale. The opportunity now presents itself—such an opportunity as can never be expected to recur—of handling the whole question in a statesmanlike manner, and placing water carriage on an entirely new plane of service to the community. But for this purpose, the limiting proviso "for the period of the war" must be abandoned, as the work will take years to accomplish, and, indeed, it cannot be put in hand at all during the war owing to the more pressing demands for labour in other directions.

How should the scheme be carried out? With animal haulage, electric or steam traction from the banks, or the use of steam tugs? These appear to be the main alternatives, and of these we may at once condemn the first as too slow, and too costly. For an answer to the remaining questions we may look abroad and see what has been done on the Continent, where water carriage has sustained a vastly greater development than in this country, thanks to the intervention of the State. In Northern France, long stretches of the Canal d'Aire et de la Deule have been electrically equipped in comparatively recent years, with satisfactory results, in the neighbourhood of Douai; in Germany, the Teltow canal, some 37 km. in length, was equipped with electric haulage from the commencement of its existence, and has been in operation for ten years. Full information regarding these installations will be found in several numbers of Vol. 60 of the Electrical Review, and numerous articles have appeared in our pages from time to time in which we have advocated the improvement and electrification of our extensive system of waterways, which comprises some 4,670 miles. The Douai canal system includes some 52 miles of route electrically equipped; this region is now in German occupation, being situated between Arras and Lille.

From the experience gained on these and other electrical systems, and the many experiments that have been carried out with haulage by tug-boats (steam, oil, and electric), road, rail, and elevated tractors, &c., there is little room for question that the best method of haulage yet devised is that of electric traction on rails; this has been proved thoroughly successful in France and Germany. The cost of installation, apart from the power transmission lines, is approximately £1,000 a mile, which cannot be regarded as prohibitive, and where the traffic exceeds two million tons a year its adoption is considered to be justified. Now, it can hardly be doubted that this figure would be far exceeded on the main arteries of traffic in this country, under an energetic and enlightened board of control, and the supply of power would present no difficulties, in view of the numerous power stations which are already in existence on such routes. By far the greater cost would be that of improving the canals themselves, as mentioned above, to make them capable of carrying throughout barges of 100 tons' capacity as a minimum. Private investors cannot be expected to provide the funds, in view of the existing conditions of canal traffic, and the fact that many of the canals are owned or controlled by the railway companies, with which they ought to compete, is a further argument in favour of the establishment of a Board of Waterways to deal with the whole matter, with the assistance of the State. We trust that this unique opportunity will be seized and turned to account. We do not suggest that the whole of the British canals should be rejuvenated at once; many of them are useless, or lie in such unfavourable country that it would not be wise to spend money on them. It must not be forgotten that the conditions on the Continent, as regards profile, water supply, &c., are far more favourable than here. But we do think that the reorganisation and improvement of the four great waterways recommended by the Commission should be taken in hand as soon as possible, to be followed in due course by such other canals as are shown to be worth the labour and expenditure.

Liquidation of German Electrical Companies in Russia.

The question of removing German influence from the large electrical and electrotechnical concerns in Russia was considered at a recent meeting of the Special Committee for Struggling with the German Hegemony. The cases particularly considered were those of Siemens & Schuckert, Siemens & Halske, the General Electricity Co., the Electro-Peredatch, and the 1886 Co. The representative of the Ministry of Trade submitted three ways for dealing with these companies. First, liquidation; secondly, purchase by the Treasury; and last, Government participation in these companies in order to establish proper control over each of them. The Committee decided in favour of the first proposition being adopted by the Trade Department, namely, the liquidation of all five electrical concerns. The working out of the details of the project was confided to the temporary board directing these companies, and the Committee indicated in general terms the main principles governing, and the manner in which to effect, the liquidation. It was proposed by the Committee that bearer shares in all five companies should be suppressed and exchanged for nominal shares. The present holders of shares will have the option of declaring for exchanging their shares for nominal shares of the company to be formed to take the place of the one liquidated. The exchange of shares will be permitted only in respect to those of the holders who remove all doubt from the point of view of their relations to German capital. As to the remaining shares, these will be bought by the Government at a nominal price, or will be deposited in the Treasury, which will thus take part in some of the concerns, or they will be sold by the Treasury at current quotations as registered shares. It is proposed that the liquidation of all five electrical companies should be concluded by July 1st this year.

THE ELECTRICAL INSTALLATION AT THE BRITISH INDUSTRIES FAIR.

Through the courtesy of Messrs. Tackley & Co., Ltd., of West Kensington, the contractors to the Board of Trade for the electric supply to the British Industries Fair, which is being held at the present time at the Victoria and Albert Museum and Imperial Institute, we are able to briefly describe the system of wiring which has been adopted to meet the very special conditions of this temporary installation.

Direct current is supplied from the Office of Works plant in the building at 220 volts pressure through 250-ampere main switches and fuses, to a five-way double-pole switch and fuse distribution board, which forms the starting point of Messrs. Tackley's installation in the Victoria and Albert Museum. This is a slate panel board, with front connections and glass-protected fuses, and is carried on battens clear of the wall; it, together with a supplementary cable, with ironclad main switch and fuses, which was added owing to the heavy demand, supplies six sub-distribution boards in various parts of the exhibition, *i.e.*, the North Court, South Court, L Section, H Section, Smoking Room, and Fancy Goods Section.

The main distribution cables—all braided V.R. 800-meg. grade—which supply the sub-distribution boards, are all run overhead, well above the stands and clear of gangways, being strung from 7/18 galvanised straining wire by means of leather suspenders, and were installed before the stands were erected. Aerial distribution, well above all obstructions, obviously facilitates work of this kind, and in some cases the cables are carried through windows and across courts between buildings, the straining wire being attached to trees.

The sub-distribution boards, usually 8 and 10-way, are all arranged for 10 amperes per way, and are of the protected-fuse type, in glass-fronted boxes.

A feature of the work is the method of attachment adopted, as no interference with the structure of the building is permitted.

To overcome this difficulty, the straining wires are attached to special clamps round pillars, &c., felt pads being inserted to prevent abrasion, &c.; the sub-distribution boards similarly are attached to battens on pillars, &c., and held in place by straining wires passing round the latter. Each sub-circuit feeds to a main switch and fuses on particular stands, through 7/20 V.R. cable, which in turn feeds a 3-ampere circuit carrying, roughly, 20 30-watt metal lamps, distributed over one or more stands as required. In some cases such sub-circuits are continued to several points, the 7/20 cable being looped-in from board to board, but in no case does a local lamp circuit carry more than 3 amperes, this being the limit prescribed by the London Fire Brigade authorities. The current densities prescribed by the I.E.E. wiring rules are adhered to; a limit of 1,000 amperes per sq. in. is adopted for 3/22 and all small cables.

Turning to the stands, which are, of course, temporary wooden structures, the whole of the casing, &c., carrying wiring is visible, being on the surface to comply with Fire Brigade regulations. The sub-circuit wires are led down from the aerial runs to protected type fuses and switches mounted on a base board which is fixed on to a uralite slab, space being left for ventilation between board and slab, and the latter is fixed to the face of the finished stand—that is, over any drapery, &c. In every case electrical switchgear, fuses, &c., are backed by a sheet of uralite as a protection against fire. Most of the fittings are plain pendants with opal shades, but on a number of stands where decorative effects are desired, very elaborate fittings, with cut glass and alabaster bowls, and fancy shades, are employed.

Although the controlling switch and fuse boards on stands, for the lamp circuits are in all cases limited to 3 amperes, these fittings are of large size, and could, if necessary, carry 15 amperes.

In the case of one or two stands it was not advisable to run the wiring on the surface, and in such cases it is run in screwed steel tubing, which is efficiently earthed.

In a few cases the wiring was erected before the stands were completed, and the flexible lamp suspensions have to pass down through draped ceilings; in such cases a 4-in. diameter asbestos washer is attached above and below the draping, the flexible passing through a 2-in. diameter hole in the centre. The flexible employed is 35/40 V.R., or larger; the ceiling roses are all of the loop-in type, with the terminals screwed from the back; and the lampholders are all of the one-part type (in which the terminals draw out of a china socket).

Zenith metal-filament lamps are used throughout; these were made specially robust, and carefully tested at the makers' works (at Harlesden) in view of the 3-ampere lamp circuits serving several stalls.

The installation at the section of the Fair held in the Imperial Institute has been similarly carried out; it is devoted to toys, games, &c.; a number of electric kettles, urns, and small motors for working models are installed, and where plugs are provided for heating equipment of any kind, a ruby lamp is fitted in parallel with the plug to show when the circuit is in use.

Altogether, between 400 and 500 stands are supplied, 2,000 to 3,000 lamps being used, including a few half-watt fittings on large stands.

It is interesting to note the quantity of material which is absorbed in a temporary installation of this kind; we understand that some 10½ miles of 3/22, 3¼ miles of 3/20, 7½ miles of 7/20, ¼ mile of 7/14, and ⅛ mile each of 19/16 and 19/12 cable have been used, together with 16,000 ft. of 2 in. capping and casing, 27 gross yards of flexible, 1,600 insulated eyelets for suspensions, and over a 1,000 fancy glass shades.

Messrs. Tackley are responsible to the Office of Works for the whole of the energy consumed on the installation, as measured by meters in the two buildings, and the tariff to stall-holders—as approved by the Board of Trade, under whose auspices the Fair is being held—is in the form of an inclusive fee for unlimited supply of energy during the Fair per lamp installed, Messrs. Tackley providing and maintaining the installation.

In conclusion, we must congratulate the contractors on having undertaken such a large installation despite difficulties in the matter of labour and material; especially so as they are at the same time maintaining electrical installations in five camps, and naturally have a greatly reduced staff available.

The work as a whole has been personally supervised by Mr. W. C. Tackley and Mr. H. G. Hoad, the latter of whom was, we understand, for many years in charge of installation work carried out by the London County Council.

RADIATORS.

By "EXPERIMENT."

An electrical friend, some years ago, spoke rather bitterly of his firm because the principal had asked him to test various types of radiators. Said he, "It is evident that all the heat which goes into the radiator must come out of it, and therefore the efficiency of every radiator must be 100 per cent." This appears sensible enough; but the fact remains that the modern real red-heat radiator, to borrow Mr. Bastian's slogan, is far better than the old lamp type for communicating heat to the user. Let us then admit that, while they all give out the whole of the heat put into them, some radiators practically are more efficient than others.

Most people, however, think that one hot-wire heater is as good as another, and in choosing patterns they are guided by price and general appearance, and, just now, by the chance of getting delivery. That certainly was my own position a short while ago. Then I happened to sell a radiator of a well-known pattern to a consumer, and while it was on the railway, I lent him one made by another firm. To my surprise, he complained that the new one gave nothing like the heat of the lent one, and demanded that it be changed. I thought that the difference lay in the imagination of the user, but when other people said the same thing, I began to look into the two types, to see if there really was a difference between them.

A careful examination showed that they were not quite the same. In the favourite pattern, the heating spirals are fixed close to the fireclay bar, which soon becomes very hot, while in the other radiator the spirals are kept well away from the bar, which keeps much cooler. In running, the fireclay bar of the first one radiates heat freely, while in the second one this part of the heat is carried away by air which circulates freely round the hot wires. Now, hot air is of very little use, whether from a radiator or a politician. It streams up to the ceiling, and very likely runs away through the ventilator. The man who is warming himself at the heater usually stands or sits in front of it, and naturally he judges the effect by the amount of radiant heat coming towards him.

Now we see why the old lamp radiator was a failure. Glass is opaque to radiant heat, which, therefore, cannot get to the man who wants warmth. The heat sticks at the glass, and is wiped off it by the air which streams over its surface. I once supplied a hot-wire heater to a man who had been using the lamp type. Standing with his back to the radiator, he remarked that it gave out no more heat than the old one. At that moment his trousers began to smoke, and as he skipped away, he agreed that there was a difference.

These facts point to the principles which should prevail in electric heater design. As far as possible all heat should be radiant. One way to achieve this would be to arrange the spiral heaters horizontally in deep grooves in the fireclay bars. The container should further be arranged to prevent air from passing over the bars. This would mean that the bars should be of larger section to get rid of their heat without rising to too high a temperature, but that would greatly increase the useful heat emitted. As both bars and wires would be radiating heat, it is probable that a radiator on these designs would give even up to 50 per cent. more warmth to anyone standing in front of it. It is worthy of note that few radiators on the market are made on these lines. Most of them have more or less vertical spirals, doubtless arranged for the air to pass over them, so that the heat may be absorbed as quickly as possible. But if the improved design will give as much, or more, useful heat with 1,500 watts as the ordinary type will give with 2,000 watts, the design will be worth the extra cost.

On coming to this conclusion, I wrote the makers of one radiator, pointing out that their pattern gave too much hot air and not enough radiant heat, and my reasons for that conclusion. The fact was obvious enough ; indeed, the designer had probably had air heating in mind when he got out the pattern. Yet, instead of weighing up the pros and cons, the makers wrote back that their radiator gave great satisfaction to other people, and even suggested that I might be prejudiced against it. One can only regret an attitude of that kind. Of course, no one expects makers to alter their designs to suit everyone, but the wise maker will welcome criticism, and will not be unwilling to face facts. He knows quite well that he must please the buyer, for if that important person is not pleased it is of little use the designer being satisfied. Our British manufacturers must learn to follow in the footsteps of our American friends, and to look out for opportunities for improvement. Consider how beautiful a piece of mechanism is the modern typewriter. Here one might think that makers might justifiably be content to rest on their oars, and to throw criticism back in the teeth of the critics. And yet how far otherwise is their way. Year by year one little point after another is added, or modified, and the five-year-old design, perfect though it seemed, looks quite old-fashioned by the side of the new arrival. The same methods which gave the Yankees the typewriter monopoly are giving, or have given, them the monopoly of cash registers, electrical vacuum cleaners, fountain pens, adding machines, shaving soap, and chewing gum. All this has not happened by chance, but by the open mind that is ever looking for improvement, and that is willing to change its designs whenever change seems worth while. We must either wake up or get left behind ; but when our manufacturers condescend to use the immense stores of unutilised talent in this country, we won't need to fear the "getting-left" proposition.

But our manufacturers must learn to accept friendly criticism. There was once a man who took over a weary single-phase station. He decided to try to make it pay by increasing the output, and called for tenders for a new single-phase generator. The representative of one firm asked him why he didn't fill up the slots of the generator, and make it into a three-phaser. The engineer might have answered to this, "Sir, am I running this station, or you ?" But he didn't. He appropriated the idea, and soon the undertaking was out of the hands of the undertaker who had been waiting for the demise. The moral of this story is : don't be afraid of the criticism of the man who is trying to be friendly. He may have an idea which you can palm off as your own, and in that there is a mighty good chance of getting something for nothing.

PHANTOM CIRCUIT SYSTEM FOR CONTROLLING STREET LIGHTS.*

By A. H. Davis.

In the suburban districts of cities using a multiple system of street lighting, it frequently happens that there is not sufficient load to warrant the running of feeders exclusively for street lighting ; consequently, these lights are connected to the service or house-lighting feeder. Since house-lighting service must be continuous, the problem of turning the street lights on and off immediately presents itself.

To secure the desired control, an inexpensive and reliable apparatus has been developed by means of which the street lights can be turned on or off at will from the power station. This apparatus can be used on any alternating-current lighting system where the 2,300-volt feeders are not earthed. If the system has an earthed neutral on the 2,300-volt lines, the apparatus can still be

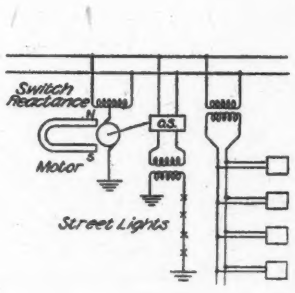


Fig. 1.—Connections of Automatic Oil Switch.

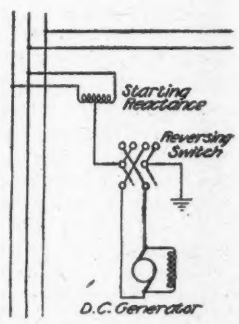


Fig. 2.—Connections of Station Mechanism for Operating Oil Switch.

used, if it is allowable to disconnect the earth wire momentarily while turning the street lights on or off. An earth on the 110-volt lines does not interfere with the switching operation.

The oil switch O S, fig. 1, used to control the street lights is usually connected in the primary circuit of the transformer from which these lights are run. This switch is operated by a small direct-current motor that has a permanent magnet field, and the switch mechanism is so arranged that a reversal in the direction of the motor's rotation operates the switch in the opposite direction. One terminal of the motor is connected to the middle point of a reactance coil and the other terminal is earthed. The ends of the reactance are connected to the two wires of the 2,300-volt feeder. The function of the reactance is to allow a

* From the *General Electric Review*. Abstract. A somewhat similar system, devised by Messrs. Duddell and Handcock and Dykes, was described in the Electrical Review of Feb. 21st, 1913.

direct current to flow from the 2,300-volt mains through the motor to earth, and at the same time to hold back the 2,300-volt alternating current. The magnetising current of the reactance is only a few milliamperes, and therefore the coil does not earth the 2,300-volt system.

The direct current is not left on continuously, but is only applied to produce the switching operation. The switch is so arranged that after being operated in one direction by an application of direct current, a subsequent application without reversed polarity will cause the motor in the switch to run idle, thus not affecting the position of the switch. However, when the polarity of the direct current is changed, the switch operates in the opposite direction, and as soon as the limit of motion of the switch is reached the motor will again run idle until the direct current is removed.

The station apparatus, fig. 2, is exceedingly simple, consisting only of a second reactance, which allows direct current to be put on the alternating-current system without affecting the alternating-current potential between wires, and of a reversing switch for conveniently changing the polarity of the direct current. By closing the reversing switch for about two seconds the oil switch on the street lights is operated, even though miles away.

Any source of direct current can be used, provided it is allowable momentarily to earth either side of the circuit. If there is no direct current available, a small generator or rectifier can be installed and run from the alternating-current lines.

Any number of switches can be operated simultaneously. In case it is desired to operate switches independently, a few parts can easily be added to the switch, so that its mechanism will be inoperative the first time the direct current is put on the system with polarity such that it tends to operate the switch, but will operate the second time the direct current is put on with the same polarity. If this special switch is used in conjunction with a standard switch, the standard switch will operate the first time the direct current is thrown on and the special switch the second time. Of course, the switches will always operate in the same sequence.

AMERICAN REPORT ON GERMAN ELECTRICAL ORGANISATION.

The *Electrical World* recently published an abstract of an account of the conditions prevailing in the electrical industries of Germany and England, which was given before the Federal Trade Commission. Some of the evidence given before this Commission has already appeared in our pages. This Commission is in favour of co-operation in foreign trade, the principle embodied in the Webb Bill, which was referred to in our issue of February 16th. Our contemporary in its abstract includes the following :—

The A.E.G. and the Siemens-Schuckert have succeeded in concentrating about 80 per cent. of the entire electrical business of Germany into their own hands. Of this about 45 per cent. is controlled by the A.E.G. and about 35 per cent. by Siemens. One of the distinctive features of the German electrical industry is the extent to which it is supported by banks. Through members of its board and executives, the A.E.G. is related to banks and banking groups representing $533,234,000. [These relationships are graphically shown on a chart prepared from data submitted by William J. Clark, of the General Electric Co., and arranged according to a design suggested by O. C. Merrill of that company, and published in the report.]

This close connection with great banking groups has assisted the A.E.G. in the promotion of foreign trade. These banks have assisted in financing many foreign undertakings in which electrical equipment was required. They have also assisted in the organisation of special banks and trust companies for electrical enterprises, preferably abroad. These banking connections also account for the credit extended in foreign trade by the A.E.G. and the Siemens-Schuckert concern. The chart also shows the extensive connections of the A.E.G. with other important German business enterprises. Some of these, such as insurance companies, add to its financial strength. Others are companies manufacturing chemicals, glass, fabrics of various kinds, iron and steel products, &c. Others are mining companies, metal buying and refining concerns. These all facilitate its purchase of materials and supplies. Still others are transportation, light, power, and public-utility companies. The A.E.G. maintains a most extensive organisation throughout Germany and many foreign countries by means of subsidiary companies. Some of these are banks for the financing of electrical enterprises; others are operating, managing, and selling companies. All in all they represent a capital investment of approximately $500,000,000.

In 1903 the A.E.G. entered, it is said, into an agreement with the General Electric Co. of America by which certain territories are respected. The A.E.G. was given the exclusive trade in Germany, Luxemburg, Austria-Hungary, European and Asiatic Russia, Finland, Holland, Belgium, Sweden, Norway, Denmark, Switzerland, Turkey, and the Balkan States, while the United States and Canada were apportioned to the General Electric Co. In addition, the A.E.G. was given the right to use the Curtis patents for steam turbines, and the General Electric Co. that of the Riedler-Stumpf patents. This agreement, however, binds only the General Electric Co., and other American concerns were not parties to it. The neutral districts, which are open to both, are said to be Mexico, Central America, South America, and Japan.

As in the case of the A.E.G., the Siemens-Schuckert group is closely connected with powerful banking groups which aid in promoting its business. Considering the Siemens-Schuckertwerke and the Siemens-Halske A.G. as an entity—the Siemens-Schuckert concern—and eliminating duplication of connection with the Deutsche Bank, the Essener Kredit-Anstalt, the Elektro-Treuhand A.G., and the Reichsbank, it appears • that German banking interests aggregating $300,000,000 support the organisation.

By some authorities it is said that the A.E.G. and Siemens-Schuckert concerns are in sharp competition throughout Germany and in many other parts of the world. On the other hand, various Americans who are well informed as to the conditions of the electrical industry of the world state that in foreign trade at least there seems to be little or no competition between them, but that frequenly they operate jointly. It has also been said in Germany that there is more or less agreement between the two, and that for several years they have not been unlimited competitors, but that the chief staple products of the two groups have been sold on the basis of a fixed schedule, all larger products, oversea as well as domestic, being handled according to mutual agreement, frequently on common account.

The abstract proceeds to refer to British investments abroad, the effective co-operative organisation of the B.E.A.M.A., and the need for co-operation among American manufacturers. It concludes :—

A special report by Julius G. Lay, United States Consul General at Berlin, dated November 2nd to 16th, 1915, is included among the various reports which were received by the Commission in connection with its investigation. In part this report refers to the electrical industry as follows :—

In certain lines there are occasionally absolute monopolies. For instance, the Vereinigung deutscher Starkstrom Kabelfabrikanten is a cartel for high-tension cables. The contract runs until 1917. This cartel is composed of Bergmann, Siemens-Schuckert, Felten & Guilleaume, A.E.G., and Süddeutsche Kabelwerke, and is an absolute monopoly. Also Akkumulatorenfabrik Berlin u. Hagen is a monopoly of the storage-battery manufactories. Siemens & Halske, and A.E.G. have bought up about 30 different storage-battery manufactories, leaving only one outsider, the Accumulatoren und Elektricitäts Werke A.G., formerly W. A. Böse. The monopoly pays 25 per cent. dividends.

The lamp business, which is of great importance, is the main field for sharp competition between the firms A.E.G., Siemens-Schuckert, Bergmann, and the Auer Gesellschaft (which makes only lamps, both gas and electric). However, patent conventions exist between these companies, and between each one of them and the General Electric in America. Altogether, there are 11 competitors making metal-filament lamps.

The German electrical concerns in European countries have their own foreign company; in South America they have their own company in the principal cities, but in some cases they have agents to whom salaried engineers from the home office are accredited and paid by the home office. The A.E.G. alone has 100 offices in continental Europe outside of Germany, and 60 offices outside of Europe.

ECONOMIC RECUPERATION AFTER WAR.*

By PROF. W. R. SCOTT, D.Phil., Litt.D., LL.D., F.B.A.

When one endeavours to pierce the veil that hides from us at present those future years which will be brightened by the return of peace, it seems as if popular opinion hovers between two opposite poles of thought. The one type thinks of peace as meaning a resumption of social and economic life just as

* Read at the Institution of Engineers and Shipbuilders in Scotland, February 20th, 1917.

it was when its normal development was interrupted by the outbreak of war. The other type is quite the opposite—it seems to regard the early days of peace as an economic *tabula rasa* upon which a new economic history may be written. Yes, a *tabula rasa* perhaps—but only in the sense that economic movements, both of the past and of the present, have left invisible traces upon it in a species of secret writing which will gradually come to light when the war is over. As differentiated from these one-sided views, there must be divined something of the future based as much as possible upon economic knowledge and the resources of past experience in so far as these are applicable. Indeed, such an inquiry, apart from its practical value, is a test of the efficiency of modern political economy, which, to the extent to which it is a science, should be able to predict. Yet prediction, as regards the present war, has been largely falsified by events to a degree which has been remarkable. Thus it is certainly safer, if less enterprising, for the economist to wait upon events, contenting himself with classifying, investigating, and pronouncing upon these after they have happened. This is useful work, but the time for much of it is not yet; rather may we not try to see, however imperfectly, something of the reaction of the present war upon the future of industry, thereby attempting to forecast the material destiny of Europe during a part of the next generation.

Moralists, poets, philosophers, economists, and statesmen have written much of the evils of war. To each nation, whose temperament is essentially pacific, there is given a clear vision of the losses involved in a state of hostilities. On its material side war involves immense destruction and waste; and it is this which has to be repaired in the subsequent years of peace —if that be possible. Accordingly, the first step will be to estimate the volume of the loss of wealth occasioned by warfare. There is, first, the loss of human productive power in so far as productive workers are killed or suffer in industrial efficiency by reason of wounds or disease due to war. Here is a war loss which is obvious, and which is irreplaceable till a new generation fills the vacant places, or, alternatively, till a new supply of labour can be drawn from elsewhere. Secondly, during the progress of hostilities highly skilled labour is diverted from productive to destructive employments. In the third place, the consequences of this are visible in the devastation to which tracts of country have been subjected which have been fought over by contending armies. Again, naval operations have involved losses of shipping. In the fifth place, the general supply services of armies in the field inevitably occasion a certain waste of stores. Then, in the sixth place, the high cost of modern war is likely to impose a certain strain upon the credit and finance of the combatant countries. In most cases immense additions to the funded debt are already necessary, and these will grow with the duration of the war. In addition, there are unfunded borrowings, whether in the form of bank credits to a Government or in largely increased issues of paper money. Sooner or later these debts must be faced, and the interest on a funded debt will impose a heavy burden on future industry for many years to come, while unfunded debts or excessive issues of paper money will probably be dealt with by the flotation of a loan when the time is judged opportune. Here, again, there will be a further charge for interest. It may be that where the credit and financial systems have become highly artificial, the position cannot be adjusted without a commercial crisis; and, if so, the losses through a temporary collapse of credit, caused indirectly through the war, must be added to the more immediate war losses. Even yet the melancholy catalogue is not complete. There remain minor factors to be reckoned. There is a certain dislocation of production which arises upon mobilisation, and again upon demobilisation. If the industries of a country were organised efficiently before the war, the diversion of demand and contraction of production usually, if not, indeed, inevitably, involve producing at a less advantage than before. Again, the closing of trade routes forces recourse to substitutes for some commodities previously used, and the substitutes are frequently either inferior, or else more costly. War, in fact, removes many of the advantages which previously accrued from territorial division of labour.

Changes of territory, too, as a result of peace terms, have to be reckoned. Here, in the aggregate, the loss to production in general is to be measured by the extent to which the new owners of such conquered or ceded districts are less efficient producers than its former owners; while, conversely, if the ultimate settlement follows the broad lines of racial divisions, a gain rather than a loss may be anticipated in the greater contentment and more congenial political affinities of the population affected by the change. Again, there is the question of indemnities, which, in principle, is closely connected with that of loans to be raised for purposes of war, adding to the debt of the country which pays the indemnity and lessening *pro tanto* that of the country which receives it. In the aggregate it would seem that this process involved a mere transfer of a claim to wealth from one country to another, but it may be questioned whether under the conditions which are likely to govern the final settlement, and where the indemnity is paid by one great power to another great power, the sacrifice of the former may not be larger than the benefit accruing to the latter. Also, there is the element, at present largely indeterminate, of the position of tariffs after the war. Clearly a state of international relations in which, after a political peace, a war of tariffs was waged, would be yet another element to be added to the long list of war losses, in so far as trade was diverted into artificial channels beyond such a degree as its course was facilitated by lesser customs duties amongst friendly nations. So much depends upon the course of the various campaigns, and the state of feeling between the present time and the declaration of peace that, while the possibilities offer a fascinating field for conjecture, the elements of the problem are too uncertain and too fluctuating to afford any firm basis for calculation. At the moment of writing it would appear that this is a phenomenon of which account must be taken.

The foregoing factors, while not exhaustive, appear to be the chief that have to be considered. It is needless to say that the list is already long, and it is a distressing one. But the mere enumeration of these conditions only opens up the really difficult problem of the degree of importance which is to be assigned to each. And that difficulty becomes intensified by the fact that all these causes will continue to operate in varying degrees during the unknown period which must elapse until peace is declared and industry can return to its normal course. Therefore, all that is possible is to attempt to signalise those causes which are likely to be most powerful in determining the *post bellum* conditions. Two of these stand out pre-eminently. These are the loss of labour power and the accumulation of debt, whether funded or unfunded. It would seem that for many years to come the great powers of Europe will be weary Titans toiling painfully under the crushing load of their public obligations. And the diminution in the supply of labour seems to make the process of recovery slower than it would have been had the slaughter been less. Moreover, the efficiency of credit has made it possible to mortgage future production to an extent previously unknown. No doubt, ultimately, the modern system of credit will enable the burden to be diffused over the production of a long period, but it can scarcely be anticipated that the transition from credit on a war basis to credit on a peace basis can be effected without a serious crisis in some of the belligerent countries, perhaps not immediately after the war, but not very long after peace has been made. Such a crisis, should it come, would delay recovery in the countries where it occurred, and it would react upon the renaissance of industry in other nations whose credit had stood the strain with less disturbance.

In confronting a situation so unparalleled, both imagination and courage are required—imagination to divine the economic conditions of the new Europe which will arise out of suffering of the old; and courage, too, in order to recover as quickly as may be and upon a secure basis, from the enormous losses which are accumulating daily. It appears to me that, when one faces the future in this spirit, the degree of *resilience* in industry may easily be under-estimated. To a very considerable extent the disorders which war is inflicting upon industry are generating antidotes. The swollen war costs are forcing economy upon the belligerent peoples. Observers of pre-war social conditions cannot fail to have noted the rapidly rising standard of living over a very great part of Europe. In the closing years of last century, and during the early years of the present one, the peoples were garnering the fruits of more than 50 years of remarkable economic progress. Thus, habits of comfortable, and even luxurious living had been formed. The present generation had become accustomed to that form of free spending which Aristotle described as the characteristic of those who, having inherited wealth, had never known privation.* War is enforcing a return to a more Spartan régime. Gradually habits of economy are perforce replacing those of profusion. But as these habits become established, their influence will persist when the war is over. Hence resources will be derived from this source, partly to pay interest on war debts, partly further to supply the new capital which will be required in large amounts to replenish working capitals and to replace buildings, plants, and means of transport which have been destroyed during hostilities. Thus there are indications that the war itself is calling into existence a fund from which some of its own waste will be repaired. War and luxury are alike unproductive expenditures; but while the latter has been continuous, the former outlay is compressed into a comparatively brief period, thereby anticipating at one bound the disbursements upon luxuries during many future years.

It is in this way that the recapitalisation of industry will be provided, and that, it may be hoped, without undue delay. It is to be remembered that the productive capacity of the extractive industries remains unimpaired, except in those cases where a war lasts so long that permanent improvements in the land may become seriously depreciated. Though factories may be stopped during the war, to a large extent their productive capacity remains. In a country whose resources are ill-developed these are the only productive losses to be faced, and the recovery of them should not be difficult, particularly if it can be aided by moderate loans of working capital from outside. A highly developed region in which there has been great destruction of buildings and machinery requires larger outlay; but it will usually either have greater means for producing the new resources itself, or it can offer security to borrow what it needs abroad. Thus it would appear that great as the call upon capital will be, means may be foreseen by which it can be provided.

(To be concluded.)

* Eth. Vic. iv. 20.

PREFERENCE FOR AMERICAN CABLES IN AUSTRALIA.

WE reproduce the following from the *Melbourne Age* for January 5th, just to hand:—

"Strong resentment on the part of British firms in Victoria has been aroused by the extraordinary preference given to foreign manufacturers when material for construction work is wanted from abroad. The procedure is said to exhibit such a bias in favour of American manufactures that all others are practically excluded from consideration. The tenders are so framed that none but American goods can possibly meet the conditions. This state of affairs is particularly noticeable in respect of tenders for insulated wire for use in the new electric signalling system. In February, 1915, tenders were called for several miles of insulated cable. Nobody objected to that, but when it was mentioned that the cable in question must be of a particular brand, and that brand the trade name of an article manufactured solely by an American firm, a vast amount of indignation was caused. Representatives of British firms, seeing that their goods were shut out from competition, immediately applied to the railway department for leave to tender, but were blandly told that unless the goods were of the particular American brand specified their tenders would be futile. It was then suggested that an article similar in every detail to that desired by the department might be considered, but this was rejected also. When asked the reason for the great regard for this particular foreign commodity, the departmental officials stated that it had been used in the past, and that any extra cost entailed in its purchase was amply made up for by its lasting qualities. One of the British firms then secured samples of the foreign wire, which had been in use for 20 years, and sent them to England, where they were subjected to rigid scrutiny, after which the firm cabled its representative here to the effect that it could make an article similar in every respect, but, of course, could not call it by the particular name used by the American firm. It also quoted prices for this work. These in every case were from 50 to 70 per cent. cheaper than the American article. A tender was then submitted. The difference in price flabbergasted even the railway officials, who suggested that it was so great that there must be something wrong. Having been reassured upon this point, they then wanted to know if the article was that asked for in the specification. Having discovered that it was similar in everything but the name, the department finally rejected the tender, and gave the order to the American firm at a price vastly in excess of the offer made by the British manufacturer. British representatives in Victoria of insulated cable firms state that the American article is quite ordinary. There is no trade secret bound up in its manufacture, and it can be made by other firms, which cannot, however, use its American name. Added to that, the British firms can make it much cheaper. At a time like this, when the railway finances are in such a muddle, and cries for economy are heard on every side, one would naturally suppose that the railway department would like to buy as cheaply as possible without loss of efficiency, yet tenders are again to be called for the supply of a large quantity of insulated wire, and the specification is for the same American brand. The representatives of British firms in Victoria do not complain of open competition, but they do object to a particular tender being earmarked for an American firm in such a manner as to preclude competition by British firms, especially when the British firms can turn out an article equally as good for nearly half the money. If in two tenders for 30 miles of cable the difference in price is £18 per mile, and the quality of the goods is much the same, there must be something very queer about a department which refuses to pay any but the higher price. The management of the railways has not been a howling success, but the least that can be done is to allow open competition in respect of the supply of cables, and give the well-beloved American article a chance to prove its superiority."

The same newspaper in its issue of the following day returned to the matter thus:—

"That they do not favour American products to the detriment of British or Australian articles is the reply of the Railway Commissioners. The Commissioners, however, while appreciating the merits of the American wire referred to, have evidently steeled themselves against any possibility of a precisely similar article being manufactured within the Empire. They state that they are in possession of a sample of this brand of wire which has been in use in Victoria for 20 years, and the insulation is just as good as ever it was. If the Commissioners cared, however, to investigate they could find British-made wire whose lasting qualities are nothing inferior and a great deal cheaper than the American product. One of the British firms which was not allowed to tender in February, 1915, can produce samples of its own insulated wire which has also been in use for 20 years, and the insulation is just as good as ever. This wire was actually compared with a 20-year-old sample of the Commissioners' favourite, and although the insulation was not so thick and the wire had been carrying a higher voltage than the American wire, it was in an equally good state of preservation.

"In their reply, the Commissioners stated that the department's settled policy was that when any commodity was required an effort was made to obtain it in Australia, and, failing that, in England. They were constantly giving preference to home-made articles and paying a higher price for them in accordance with this policy. There were, however, some cases where the interests of the railway department and the State made it necessary to go outside to secure certain indispensable articles. In this particular instance, the insulated wire was required for certain portions of the automatic signalling scheme, and the American article mentioned in the tender was the most durable for hard wear and use in damp places that was known. While fully appreciating the desirability of fostering Empire industries, they were absolutely satisfied that in using this wire they were doing the right thing. This wire was obtained for a special purpose, and was used where the strain upon the dielectric for damp and other conditions was very great. The material used for insulating purposes was made from a formula which was a close trade secret, and which had not been discovered by any other American firm engaged in the manufacture of insulated wire. The necessity for effective insulation upon wires controlling the automatic signals was very great, as the whole of the running of the trains depended upon it, and a great expense and inconvenience would result if an inferior article were used. They could not understand why it should be assumed that they were so unpatriotic on the one hand and so foolish on the other as to pay a higher price for American goods than for British. The brand of insulated wire made in America had been proven to be a vastly superior article to any other, and it was only the great necessity for its use in a most important part of the railway system that prompted its purchase.

"The question that all this special pleading suggests is: How can the Commissioners be satisfied that the American brand of wire is the best obtainable for their purpose when they have never given any other kind a chance to prove itself? The business of producing insulated wire is not a new one. The problem of deep-sea cables has been solved years ago, so that it should not be a difficult matter for any firm to manufacture insulation which will stand for a long period the dampness and strain involved in an automatic signalling system."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Inspection of Munitions.

"Commercial's" dictum, in your issue of February 16th, that the "British will always be fools," is undoubtedly to a great extent true, taken as a general statement, and he conclusively proves in his article that he is certainly British himself. I can assure him that he expects too much of the credulity of your readers in connection with his condemnation of the heads of the various War Departments and the inspectors under their control. They will not believe that all these men are fools—I doubt if any of them are prepared to accept his statement that the inspectors did not know a "cable from a cow." Only a fool would make such a statement.

What is the complaint that "Commercial" wishes to put forward? Apparently, that two Army officers made a 30-mile journey to inspect three coils of 7/22 wire, and that another gentleman made the "*same trip by train*" to see 200 ft. of motor-car ignition wire. Then he proceeds, in a somewhat effeminate style, to reproach the British War Department for its methods of ordering material and dealing with such orders, basing his argument on the above two cases. From these he tries to prove that the country abounds with "hindrances to the business-like conduct of our present task," and "that we are plagued by the business amateurs" in the new War Departments.

Britain, as the world admits, has done wonders, and the co-operation between the War Department and the manufacturers of the country has proved to be most satisfactory. Many of the leading men in the country are giving their services in assisting to increase the efficiency of the production of munitions. The inspectors, too, have in many cases been of great help to the manufacturers, and it is a fact that their presence is welcomed by those whose ideas are to turn out reliable goods as well as to make a profit on their contracts.

"Commercial" is evidently quite unaware of how the Ministry deals with supplies; and, with such a narrow outlook, I doubt if he will ever become aware of the extensive scale on which the work is carried out.

He has the usual shop foreman's contempt for forms, but it would be well if he realised that no large business is carried on successfully without what, to the uninitiated, appears to be a confusion of "triplicate advices."

I happen to be a Government Inspector, and have had to deal with such goods as "Commercial" mentions. I have also made long journeys to inspect small lots; but my mission has in most cases covered several such lots, as well as the

D

most important one of keeping in contact with the heads of the contracting firms.

It will be understood that there are very few firms in the country whose orders are limited to "three coils of 7/22" and a short length of "motor-car ignition wire." Most firms have extensive orders involving delivery over a long period, and it is often necessary in those cases to keep in touch with the work and to encourage the manufacturers to be as regular as possible in their deliveries.

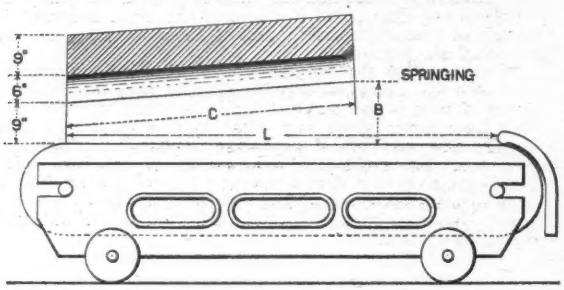
I quite agree that the "hide-bound, short-sighted policy of past years . . . still thrives in business," and I consider "Commercial" a good example of its supporters.

Albion.

Boiler-House Operation and Maintenance.

The interesting particulars of the dimensions given on page 193, Vol. LXXX., No. 2,047, of the furnace arches adopted at the generating stations at Brakpan and Vereeniging opens up a question which has not been given sufficient attention by boiler manufacturers, although the design of the furnace setting is a problem intimately connected with the burning of fuel, having regard to efficiency and smokeless combustion.

The sketch below gives an example of the empirical formula which has been developed at the Wood Lane Works of the Kensington and Notting Hill Electric Lighting Com-



panies, with very satisfactory results, and may be useful to those who have to settle the dimensions of furnace arches for given lengths and areas of chain-grate stokers.

The formula submitted is not to be taken as final, although it represents a good start. Further, slight alterations will suggest themselves under varying conditions, and the class of coal used.

Formula.

L = the effective length of the grate.

C = L × 2/3 plus 6 in. added for every foot of width between the furnace walls exceeding 5 ft. 0 in.

B = L taken in feet × 2.5, the result to be considered as inches.

C. Mancha Bennett,
Engineer.

London, *February 23rd*, 1917.

Fuse Failures.

As one privileged to witness a series of experiments carried out by Mr. Baynes, I venture to add a few remarks to those penned by Mr. Berry in your issue of February 16th as to the aim of these investigations.

According to my understanding, the object of these experiments was to confirm the conviction acquired as to the unsuitability of the use of metal-work cases in conjunction with fuse gear; which, as the article mentions, decided Mr. Baynes to adopt stoneware to remove the added danger of the arc spreading by a conducting case.

Mr. Berry's suggestion of the necessity of a "temporary expedient" is just the very risk that Mr. Baynes desired to guard against, being a more general practice than is appreciated.

Assuming that Mr. Berry's ideal fuse possessing an emergency "temporary expedient" has been realised, then it seems somewhat illogical to design a fuse with ample clearances without regard to the surrounding (usually earthed) metal case having equally safe clearances from live parts, the importance of which Mr. Berry makes no reference to.

From the photographic results of blowing a fuse (4 in. break), the size of iron box required to escape the arc would not be practicable, and the added internal mechanism of certain combinations of switch fuse gear would aggravate these conditions.

It was the above facts that induced Mr. Baynes to continue on with his views to call for non-conducting cases.

The adoption of either the "Zed" type or Messrs. Berry's pattern cannot correctly be regarded as a "graceful concession," but merely a question of merit of design, on which basis the fuses which my company submitted at the time were also considered.

The British Central Electrical Co., Ltd.
E. S. Conradi.

London, E.C., *February 21st*, 1917.

Curious Trouble with Lead-Sheathed Cables.

The troubles mentioned by Mr. Partridge in your issue of the 23rd inst. are very interesting, and are, I believe, due to continued bending and straightening of the lead at the points of fracture.

Such fractures are very common on aerial lead-covered cables carried on a suspension wire, and are due to vibration set up by the wind, failure taking place at the points of suspension where the vibrations are damped off.

As Mr. Partridge experiences the trouble in quiet as well as in busy thoroughfares, it would appear that vibration is only a secondary, but contributing, cause, the primary cause being the natural expansion and contraction of the cables due to the difference in heating between full and light loads.

The fact that some joints failed at both ends, and others at one end will be due to the stresses set up affecting both ends equally, or one end more than the other, due to (1) the symmetry of suspension or otherwise of the cable in the manhole, or (2) to the joint not being in the middle of the manhole, or (3) to the unequal expansion into the manhole from the stretches of cable on either side.

The last factor is influenced by the levels of the cables; if the cables fall from one manhole to the next, the tendency is for them to expand and contract downhill, a fact which explains the creeping of cables downhill when they are subjected to alternate excessive and light loads.

Possibly Mr. Partridge's cables are now operating at higher loadings than usual.

W. Nairn.

Glasgow, *February 24th*, 1917.

The trouble experienced by Mr. G. W. Partridge is rather an interesting one, as it brings to the fore a difficulty which may occur more repeatedly as stations are linked up by long trunk mains.

The information given in the letter neither states the size or sizes of the cables affected, nor the current densities at which they are run, so that it is impossible to work upon any definite data in this respect. I venture, however, to give the following suggestion, although it may have already received consideration.

It is generally accepted that the safe increase of temperature of a paper-insulated cable, with initial temperature of 60 deg. F., is approximately 90 deg. F. With this increase of temperature due allowance should be made for expansion and contraction of both the copper conductors and the lead sheathing at the joints. If one takes the coefficient of linear expansion of copper at .0000103 per deg. F., a 100-yard length of cable will expand, for 90 deg. rise in temperature, 3.33 in., or 4.8 ft. to the mile.

Under the same temperature rise, the lead sheathing would have an expansion of 5.18 in., or 7.7 ft. in one mile.

The lead sheathing being the outer and unserved would not attain this temperature rise, but, assuming the rise is 45 deg. F., the expansion of the sheathing would be 2.59 in.

Now, since the plumbed joints in the pits can be taken as fixed or rigid ends of a cable, the expansion and contraction has to be absorbed between these two terminations.

The lead sheath, being stiffened at the plumbed joint, has very little movement, but at the position where the cracks have developed the lead, being ductile, gives to variations in length, and it is presumably the subsequent fatigue which has brought about the failure.

It would be interesting to ascertain whether the cracks close when no energy is being transmitted, and open out when the amount of energy transmitted is at its maximum.

Mr. C. J. Beaver, in his paper on "Cables" (I.E.E. *Journal*, Vol. 53, No. 238, pages 65/66), gives some interesting results of tests on expansion and contraction of cables.

I might mention that Messrs. A. Reyrolle & Co. are the manufacturers of a special expansion joint for all voltages up to 20,000.

S. M. G. Teal.

Hornsey, London, N., *February 25th*, 1917.

The Homogenous Lead Coating Co.

My attention has been called to a notice that has been appearing in the technical Press that I have sold my interest in the Homogenous Lead Coating Co. Whilst this is a fact, the wording is misleading, as it implies that I am not entitled to carry on similar work.

I shall have before long the most up-to-date works, appliances, and processes for producing every description of lead-lined vessels and tanks for chemicals and other purposes.

Sherard Cowper-Coles.

Sunbury-on-Thames, *February 23rd*, 1917.

British v. German Turbines.

I have very much sympathy with Mr. A. Nichols Moore because, while he has been running A.E.G. turbines for 3½ years, I have been running them successfully for 10½ years. I may say that upon overhauling last year one bearing showed the original scraper marks that were made 10 years previously. But the clearances allowed in the labyrinth packing are very

small, and in some cases a seizure means a new shaft. Their metallurgical knowledge also appears to be peculiar, as they put bronze and iron or steel together, so as to form electrolytic couples wherever possible. Their steam consumption is fair when new, but very quickly deteriorates, and I, personally, am delighted to have a change to British turbines, although I believe very much more depends upon the man who actually looks after the plant than upon the nameplate.

W. H. Sisson.

Stoneclough, *February 24th*, 1917.

P.S.—The A.E.G. also designed their early turbines so that it took a few days to get inside, and a similar time to replace and refit. Their experiments with nickel and other steels for turbine blades were also very unsatisfactory from the users' point of view.

Meirowsky Insulating Tubes.

Referring to the paragraph "Meirowsky Insulating Tubes" in your issue of the 16th inst., kindly note that I am Mr. George Schultz still and have not changed my name, but that it was my son, Mr. D. H. Schultz, who changed his name and is now Captain Scott.

Regarding the last paragraph on page 175, it seems to me that the reference to "'sharp practice" may easily be construed to refer to my firm, George Schultz & Co., Ltd., but such reference did not apply to us.

Geo. Schultz.

London, E.C., *February 22nd*, 1917.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

B.T.H. Hand Lamp.

The British Thomson-Houston Co., Ltd., Rugby, has introduced a new type of hand lamp, which is primarily intended for workshop and factory use, is strongly made to withstand rough handling, and embodies certain improved features. Each lamp consists essentially of three parts; a handle, a holder, and a guard

Fig. 1.—The New B.T.H. Hand Lamp.

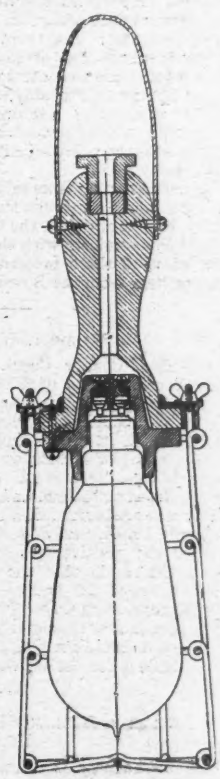


Fig. 2.—Sectional View of B.T.H. Hand Lamp.

The handle is made of ebonised wood, and furnished at the top with a rubber ring and insulated bush through which the flexible cord enters. It is further provided with a leather strap or handle securely attached by means of brass screws of such length as to prevent the possibility of their entering the wire-way in the centre of the handle.

The holder is constructed entirely of porcelain (apart from the plungers), and is provided with a flange whereby it is attached to the handle. This attachment is effected by screws which pass through the flange of the lampholder, through a wooden flange at the end of the handle, and into a metal ring slipped over the latter. The attachment is therefore not dependent on wood screws fixed in the end grain of the wood. The holder is provided with a skirt entirely covering the cap of the lamp, and is so designed as to permit of easy wiring when unmounted.

The guard consists of strong galvanised iron wire made up in the form shown in the illustrations, and is secured to the handle by two brass wing-nuts. The attachment is made through two slots in the periphery of the metal ring referred to above, and so contrived that by slackening the wing-nuts a couple of turns, the guard can be disengaged by rotating it about the axis of the lamp. The size of the guard is large enough to accommodate any lamp up to and including 60-watt standard Mazda.

This hand lamp, which passes Home Office requirements, is entirely of British design and made at Rugby.

A New Demagnetiser.

The permanent magnetic condition imparted to pieces finished in magnetic chucks is clearly objectionable on some classes of work, as milling cutters for instance. Such cutters would attract and hold the chips produced when cutting, and they would act as some hindrance to maximum production as well as an annoyance to the operator. The demagnetiser here illustrated in diagram is built by Messrs. J. H. Humphreys & Sons, Oldham, for rapidly demagnetising pieces, and avoids some disadvantages of rotary-magnet patterns. It does not require any fixing, and can be put to work in any position. The complete equipment consists of demagnetiser

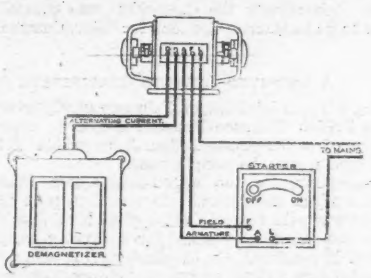


Fig. 3.—Humphreys Demagnetiser.

(shown in plan), rotary converter, and starting rheostat. The demagnetiser contains fixed coils and is operated direct by a low-voltage alternating current supplied by the converter, which through the starting rheostat is connected to an ordinary direct-current lighting or power circuit. The converter spindle runs in ball bearings, and the brush gear, terminals, and wire connections are enclosed, no loose wires being exposed. The work is passed over the polished platens of the demagnetiser once, or in the case of heavy pieces, twice, the whole operation taking a few seconds. Pieces much larger in size than the platens can be thus demagnetised.—*American Machinist.*

LEGAL.

London County Council and Tramway Rating. Settlement of Outstanding Appeals.

Following the decision of the County of London Quarter Sessions in favour of the London County Council in the latter's appeal against the quinquennial assessment of its tramways in the Borough of Finsbury, the Council and the Assessment Committees concerned have now agreed the figures in the remaining appeals. These related to tramways in Holborn (parishes of Saffron Hill, St. Andrew-above-the-Bars, and St. George-the-Martyr) and in Bethnal Green, and the Council's costs are to be repaid by the respective Assessment Committees.

In the case of the three Holborn parishes the County Council have secured a reduction of £787 in the gross value, which now stands at £8,453; and of £787 in the rateable value, which is now £3,261. In the case of Bethnal Green, the gross value has been reduced from £5,819 to £3,019, and the rateable value from £5,255 to £2,455. The total reduction of rateable value in these two boroughs is, therefore, £3,587.

The rateable value of the tramways in Finsbury was reduced by Quarter Sessions from £9,770 to £6,527, and the Local Government Committee of the County Council intimates that this reduction is equivalent to 33 per cent. of the rateable value in the list. As, however, reductions had already been made by the Assessment Committee, the total reduction represents 47 per cent. of the assessment in force before the quinquennial valuation, and 57½ per cent. of the assessment in force at the quinquennial valuation of 1910.

When the appeals relating to the tramways in Holborn and Finsbury came on for hearing, Mr. Clavell Salter, K.C., M.P. (on behalf of the Holborn Union Assessment Committee), raised a preliminary technical point—namely, that the County Council was not entitled to have the appeals heard, because the notices of

objection to the valuation lists did not comply with the provisions of the Valuation (Metropolis) Act, 1869, as they did not state the alterations which the Council desired to have made, nominal figures only having been inserted. The Court decided against this objection, but assented to Mr. Salter's application for a case to be stated for the decision of the High Court upon the point. As a result of the agreement arrived at, the Assessment Committee will not proceed with this case.

The Local Government Committee of the County Council has had before it a statement showing the effect of the quinquennial valuation of 1915 upon the assessment of the Council's tramway undertaking. The total rateable value is £266,475. The rateable value of the tramway buildings, as compared with the valuations in force before the quinquennial valuation, shows an increase of £12,462. This increase is mainly due to the substitution of turbines for reciprocating engines at Greenwich generating station, but some increase has been caused by the enlargement of the capacity of Abbey Wood car-shed and Vauxhall and the Elephant and Castle sub-stations. The total rateable value of the lines has been reduced by £45,171. These reductions are in addition to those amounting to £51,087 (net), which were made in 1913-14, consequent upon motor-omnibus competition.

The Committee states that it was most anxious to avoid litigation and the expenditure of public money, especially under present conditions. It accordingly entered into negotiations with a number of Assessment Committees, and, with the exceptions of the Holborn Union and Bethnal Green, was able to arrange terms which it felt it could accept on behalf of the County Council. In regard to those two exceptions prolonged negotiations took place, and the chairman (Mr. E. L. Meinertzhagen, J.P.), had a number of interviews with representatives of the assessment authorities, but notwithstanding his efforts a settlement could not be arrived at. Accordingly the Committee was compelled to allow the matter to go to Quarter Sessions for determination.

A Disputed Leaving Certificate.

In the King's Bench Division, on February 22nd, before Mr. Justice Atkin, the British Thomson-Houston Co., Ltd., appealed against the decision of a Munitions Tribunal, in which Henry Sabin, a night watchman, was the complainant.

Mr. Maddocks, for the appellants, stated that Sabin was engaged as a night watchman. He was first paid 28s. per week, and later he was paid 43s. 9d. He applied for a rise in wages, and as this was not granted, he asked for a leaving certificate, which was refused by the firm. On the matter going before the Tribunal, it was decided that unless the firm were prepared to pay Sabin 49s. a week, it was unreasonable to refuse him the leaving certificate. There was no district rate of wages on which the firm could rely. The onus was upon Sabin to prove that he was entitled to a higher wage. Evidence was given before the Tribunal from two firms that higher wages were paid than those prevailing in the appellants' firm. On the other hand, evidence was given that lower wages were paid in some neighbouring works.

Mr. Slesser, for the complainant, contended that sufficient evidence had been afforded to enable the Tribunal to arrive at a decision as to the amount which should be fixed. The Tribunal heard the evidence of five witneses before coming to a decision.

Mr. Justice Atkin found that the Tribunal had no evidence upon which they could find that the amount fixed was the prevailing rate of wages. The appeal would be allowed.

High-Tension Electrometers for X-ray Apparatus.

Before the Controller of Patents, in the Patents Court, on Wednesday last week, Messrs. Fredk. R. Batt & Co., Ltd., London, applied for licence to use the German Patent 25,101, of 1912, in the name of Bauer, for the manufacture of high-tension electrometers to be employed in connection with X-ray apparatus. Patent 25,101 covers the combination with a unipolar electrometer, for connection to a high-tension circuit, of a casing surrounding the electrometer, the casing provided with means for reading the deflection of the electrometer, and being composed of material which readily gives up its charge to an ionised surrounding medium. The casing is readily penetrated by Röntgen rays. The high-tension electrometer comprises fixed metal plates, metal vanes carrying an indicating number, mounted to rotate relatively to the plates, and a spring tending to rotate the vanes in one direction, the casing surrounding the plates, vanes, and springs being provided with means for reading the deflection of the vanes.

Mr. J. H. Webb, the secretary of the company, said they had received orders for the Bauer electrometer. They had had difficulty in getting them from the firm who had obtained a licence to manufacture, Messrs. Newton & Wright. He concluded that they were not in a position to manufacture. Any firm making these electrometers needed to have special facilities. His own firm possessed special advantages for manufacture and sale. The Bauer electrometer was nothing more or less than an electrostatic voltmeter, and, to make one efficient in every way, a firm required to have a very good knowledge of the working of such instruments. They were somewhat difficult to manufacture, the mechanical parts rather than the electrometer. It was essential to employ the proper material in manufacture, otherwise the instrument became at once absolutely inefficient. The meter had to be placed on the secondary circuit of an X-ray apparatus for making measurements of the working of the X-ray outfit. The applicants were one of the largest manufacturers of X-ray apparatus, and were official contractors for the War Office. They held the opinion that if they could supply to the War Office, or to their X-ray Committee, an instrument made under the Bauer patent, which was absolutely efficient and made to their satisfaction, they would probably get a very large sale for it. He had been in communication with a firm of great repute in the manufacture of electrostatic instruments, and had made arrangements for early manufacture. The applicants themselves employed 90 men in manufacturing X-ray apparatus for the War Office. Every X-ray apparatus they used to sell in pre-war days included a Bauer electrometer, as they held it to be an integral part of the outfit. Since the war, however, these Bauer electrometers had not been included. The apparatus need not necessarily be used for surgical purposes. He proposed to pay a 5 per cent. royalty on the patented parts which the applicants fitted and manufactured. He wanted to advertise his firm as being in a position to supply, and in all probability the Bauer electrometer would be separately priced.

The Controller said he thought the case was one in which a licence should be granted. The royalty would be subject to revision after the war, and it would be foolish at this stage to put on a prohibitive royalty. The Board of Trade wished to promote the manufacture of a useful appliance, and it was well that the sale price, according to the cost of production, should be fixed within a reasonable limit.

Meirowsky Insulating Tubes.

A supplementary application to one reported in the Electrical Review of February 16th last, for licence to use the Meirowsky patent for insulating tubes, was heard in the Patents Court on 21st ult.

Capt. Donald Henry Scott applied for licence to use Patent 26,941 of 1906 covering this improved method and apparatus for forming insulating tubes.

The application was heard by the Controller of Patents, Mr. Temple Franks, and Sir Cornelius Dalton.

Capt. Scott (who had changed his name from Schultz to Scott) was conducting the English business of Meirowsky & Co. when the war broke out. He felt that upon him devolved the liability of carrying on the business. He was an English subject, and when he joined the Forces he invited Messrs. Schultz & Co., the well-known firm of electrical engineers (of which his father was managing director), to go to Manchester, take up the business, and manufacture under the patent.

Mr. Temple Franks said he saw no reason why the Court should not recommend the Board of Trade to grant a licence to him, and in the ordinary course that licence could be transferred to approved assignees. The Court would certainly suggest that his father, as representing Schultz & Co., would be an assignee that would be approved by the Board of Trade.

Mr. Moritz, representing Capt. Scott, said he understood the Board of Trade Committee would consider the case of the Meirowsky company, as they had given notice to that effect.

Mr. Franks: Were there no machines?

Mr. Moritz: Yes, of course, there were machines. I suppose they would have to control the transfer of these.

Mr. Franks: Probably it is not exactly a legal position at the present moment. Therefore, you want a proper transfer from the Controller to Schultz & Co. of the assets and machines.

Mr. Moritz: My client is willing to buy up the assets of Meirowsky & Co.

Mr. Temple Franks said if this were done, it would be an additional reason for recommending that a licence be granted to Capt. Scott, but, in any case, the Court would recommend a licence. He would communicate with the Board of Trade, and transmit to them the effect of those proceedings, and the applicant would, in due course, hear from the Board of the issue of the licence.

Wilde *v.* Walsall Electrical Co.

At Walsall County Court, plaintiff sued defendants for £5 19s. damages arising out of the repair of certain electrical apparatus.

For the plaintiff it was stated that he used a mercury vapour lamp for producing artificial light. In December something went wrong with it, and plaintiff's manager went to the defendants' works and saw Mr. Brown, defendants' manager, who eventually agreed to go down to plaintiff's premises. He found a wire had either fused or broken, and he repaired it. Subsequently, when the lamp was again lighted, a bulb fused, and the lamp was destroyed. Plaintiff subsequently found that by mistake Mr. Brown had connected the positive wire with the negative plug, and *vice versâ*, with the result that the current was reversed, and caused the destruction of the lamp. For the defence, it was contended that Mr. Brown explicitly told plaintiff's manager that he had had no experience with mercury vapour lamps, and merely offered to do the best he could for plaintiff out of a spirit of kindness.

Judgment for the defendants, with costs.

Fowler *v.* Midland Electric Corporation for Power Distribution, Ltd.

In the Chancery Division, on Monday, Mr. Justice Eve delivered judgment in an action in which the plaintiff sought to recover the value of 18 £100 debentures issued by the defendants, and interest. The company had paid £1,800 into Court, together with interest up to June 30th, 1913, and a premium of £45, and the real claim was for interest subsequent to that day at 4½ per cent.

His Lordship said the action raised the question whether it was the duty of the issuers to seek their creditors "within the realm," and to pay the money without request. His Lordship held that the company was supplied the day after the debentures matured,

with the information as to the proper person to whom tender of payment might be made. He thought there was no defence to the action, and he gave judgment for the plaintiff, with costs, for interest at 4½ per cent. as from June 30th, 1913, ordering the payment out to him at the same time of the amount paid into Court by the defendant company.

WAR ITEMS.

The Tramways of Vienna.—According to the "Daily Telegraph," if you want to travel by tramcar in Vienna now you must do so either between 5 a.m. and 9 a.m. or between 5 p.m. and 9 p.m. These are the only times when the tramcars run now. "Grave popular discontent has resulted."

Fire at Cockerill's Works.—A great fire at the famous ironworks of John Cockerill & Co., at Seraing, near Liège, has resulted in damage to the extent of £80,000. The cause of the fire is attributed to the enemy.—*Financial Times.*

Copper.—The Central News Paris correspondent says that the French Government will shortly submit to the Chamber a Bill making compulsory the declaration to the authorities of all copper or copper materials of any kinds except by persons holding less than 50 kilogrammes.

Engineering Wages.—The Mersey engineering employés who had applied for a 10s. per week advance, have by 1,700 votes to 1,410 (a total poll of 3,110 out of 8,000 members) accepted an award of 4s. awarded by the Committee on Production.

Higher Railway Rates after the War!—Lord Faringdon, chairman of the Great Central Railway Co., is credited with a remark which suggests that there may be higher rates for goods traffic after the war, owing to the excess of expenditure as compared with pre-war conditions.

A.E.G. Workers.—The Amsterdam correspondent of the *Daily Chronicle*, under date February 24th, says that 8,000 employés of the A.E.G. in Berlin have made united demands for higher wages and sufficient food.

Restricted Lighting: Accidents.—The number of fatal accidents in the Metropolitan Police District during the hours of darkness between August 1st, 1914, and January 31st, 1917, was 954. The number killed by Zeppelins in the same district was 137.

Export Prohibitions.—The Proclamation relating to export prohibitions is further amended by an Order in Council dated February 23rd. Changes are made in a number of headings. (See *London Gazette*, February 23rd.)

Exports to China.—Further additions to the list of persons and bodies in China and Siam to whom exports may be consigned are given in the *London Gazette* for February 23rd.

Electrical Export Prohibitions.—The following articles are in the list, issued by the War Trade Department, of things which are exempted from the necessity of licence or certificate as far as the prohibitions relating to the export of steel are concerned:—Electricity meters and electrical instruments. These are otherwise included in prohibition "C," which prohibits their export "to all destinations in foreign countries in Europe and on the Mediterranean and Black Seas, other than France and French Possessions, Russia, Italy and Italian Possessions, Spain and Portugal, and to all ports in any such foreign countries, and to all Russian Baltic ports."

Non-Essential Industries and National Service.—An important deputation is to be received on March 13th by the Earl of Derby, Sir Edward Carson, Mr. Neville Chamberlain, and Dr. Addison. It will represent the Federation of British Industries, the British Manufacturers' Association, the Association of Controlled Firms, and the Employers' Parliamentary Association, and is to be introduced by Mr. George Terrell. The object is to press on the Government that in all matters relating to labour and the restriction of raw materials used in non-essential industries the employers shall be consulted prior to instead of after the issue of orders. The present system, it is contended, has been productive of discontent, of unrest, and of loss of time and output, while the result in many cases has been the rescinding or amendment of the order.—*Morning Post.*

Exemption Applications.—At the Shoreditch Tribunal, Mr. G. Benkert, of 48, Wilson Street, E.C., electrical and general contractor, appealed for H. Burningham, aged 31 years, classed C 1, an electrician, for the second time. Mr. Benkert said that the man was a qualified electrical man, and he was trusting him with the installation of a 10-wire telephone in a controlled factory, a job that he would only trust to a very experienced electrician. It was impossible nowadays to find anybody to replace hands in this business. He had a large number of contracts for electrical work for offices and buildings. The Tribunal dismissed the appeal. Mr. Benkert said he should appeal against the decision.

At the Newmarket Tribunal, the Electric Light Co. appealed for a stoker, aged 33 (married), one of two stokers employed. Three months' temporary exemption was allowed, the military authorities to try and find a substitute in the meantime.—The appeal of a youth of 18, described as a student of wireless telegraphy, for exemption until after an examination in April, was refused, but the father was informed that if he took to the recruiting officer a certificate that his son was to sit for examination within three months he would, in accordance with a War Office instruction, not be called up until after the examination.

The Military Representative at Northamptonshire Appeal Tribunal, on Friday, appealed from the decision giving exemption, with leave to make a further application, to A. Hutchins, 29, married, electrician, wireman, and motor inspector, and W. Trusler, 39, married, general labourer, both in the employ of the Northampton Electric Light & Power Co., Ltd. He said the appeal against Hutchins was on the ground of age, he being under 31, and the ground of appeal in the case of Trusler that he had forsaken what appeared to be a more useful occupation, that of a milkman, to become a labourer. Ald. F. H. Thornton, J.P., the chairman of the company, resisted the appeals. The certificates, which were for April 23rd, were extended to May 23rd, but that for Trusler was made final.

At Dover, further exemption for W. J. Holmes (39) was applied for, he being engaged in the delivery of coal to the Corporation electricity works. He is in B 1, and with the assent of the Military Representative, who said that they did not worry about B 1 men of that age, four months were granted.

At Brighton, a firm of electrical engineers appealed for an electrician, aged 39 and in class B 2, one of two left out of a staff of 18. The man, it was stated, had been in the business for 15 years, his work was skilled and important, and the Labour Exchange could not supply a substitute. Three months were conceded.

At Northwich, the Electrical Supply Co. appealed for an apprentice to electrical engineering, aged 18, engaged at a sub-station as attendant. It was claimed that the apprentice was in a certified occupation, and that much of the company's supply was utilised for munitions. The apprentice was in Class C 1 only, and the company offered, when the days got longer and the load was lighter, to try and release three other apprentices when they became of military age in April and May. The Tribunal allowed temporary exemption until May 31st.

Oswestry Tribunal has granted exemption until April 1st to Mr. W. H. Farrar (37), electrician, who is in Class A 1.

The Grantham Tribunal has disallowed a military appeal against conditional exemption held by P. A. Baxter (23), electric light and power wireman with the Urban Electric Supply Co.

At Peterborough, the Electric Traction Co. appealed for four men, with the following results:—J. G. Manning (28, Class A), tramway electrician and mechanic, three months; C. W. Armitage (29, Class A), tramway foreman, refused; G. A. Maywood (33), fitter and mechanic, three months; F. Woodman (41, B 2), traffic inspector, two and a half months.

Before the Surrey Appeal Court, the Woking Electricity Supply Co. appealed for J. D. Fowler (23), electrical wireman, in Class B 2. The Chairman said that the Tribunal were of opinion that it would be a waste of power to let a skilled man go into the ranks of a labour battalion. He should be employed in a skilled capacity. If the Military Representative could assure them that he would be employed in that capacity they would be prepared to release him; otherwise they would not do so. Lieut. Courthope replied that Fowler would probably be made a signaller. Exemption was refused.

At Shoreham (Sussex), exemption was sought for three electrical fitters engaged in the running and upkeep of electrical plant at Shoreham Camp, and who had never been badged. A final month was given in each case, the Tribunal being of opinion that if the men were needed the Military could look after them themselves.

At Paignton (Devon), the Electric Light Co. appealed for their assistant engineer, and he was, with the assent of the military, exempted until a substitute satisfactory to the company is found, the Tribunal to decide the question of suitability in case of dispute. The company had complained that a substitute sent to take the place of an electrician was utterly unfit for the position.

St. Ives (Hunts) Tribunal have granted six months' exemption to S. J. Allen, electrician in charge of the plant at the works of Messrs. Enderby & Co.

Aldershot Tribunal, on February 23rd, heard an appeal by the Traction Co. for Mr. A. E. Webster (31, general service), secretary to the company, and he was given one month final.

The North Riding of Yorkshire Appeal Court has dismissed an appeal by the Wensleydale Gas & Electricity Co., Ltd., against exemption granted until April 15th only, to the manager of the undertaking and to an electrician on the staff.

At Gloucester, the Corporation appealed for a storekeeper (32, in Class B 3), engaged at the tramway depôt. Mr. F. H. Corson, manager, said that the man was doing work which was highly specialised, the goods dealt with being quite outside the ordinary class of engineers' stores. Exemption until April 30th, with leave to appeal again, was granted.

A military appeal against conditional exemption granted last May to Mr. J. Launchberry (28), engineer in charge of

the station of the Faringdon Electric Light & Power Co., has been disallowed by the Tribunal.

At Bexhill-on-Sea, the Corporation Electric Light Committee appealed for Messrs. R. C. Carter (28), chief assistant engineer; J. L. Eldridge (39), cable jointer, in Class B1; W. C. Winborn (29), engine driver on the heavy shift, general service; F. J. Stratford (22), senior shift engineer at night; and C. Hall (21), on the day shift. Mr. C. A. Frost, borough electrical engineer, said that Mr. Carter was the sole remaining technical engineer in the department. Before the war they had a staff of 47; now they had only 25. Eight men had been released, on account of the decrease in public lighting, and they were doing more work with fewer and younger men. He added that he could not possibly do without the men appealed for. Conditional exemption, without time limit, was given to Messrs. Carter, Eldridge, and Winborn; the other cases were adjourned for a month for the provision of efficient substitutes.

At Maidenhead, conditional exemption whilst they remain in their present occupation was granted to Mr. W. L. Chubb (32), assistant engineer and deputy-manager of the Corporation electricity undertaking; G. A. Cox (32), shift engineer; and E. G. Pink (35), shift engineer.

At the Shoreditch Tribunal, an electrical wire coverer appealed for a man, aged 38 years, classed "A" for general service, a mechanical fitter, for the second time. He said that the man was the only one they had to look after the machines, and they only had two other males in their employ, whilst they had 100 women constantly employed. They had orders for about £3,000 worth of covered wire, trench wires, and other electrical apparatus for the Government. They had 100 insulating machines going, and did all their own work. This man was absolutely indispensable in case of a breakdown. The turnover last year was £17,000, and the business was keeping up. The Tribunal granted four months' exemption.

At Bridlington, on February 23rd, the Borough Electricity Committee appealed for an indentured apprentice, aged 18 years and 3 months, on the ground that he was indispensable on account of the number of men who had left for military service. It was decided to respite the appeal for a month in order that the acting borough electrical engineer (Mr. Ffrench) might try a substitute offered by the Military.

BUSINESS NOTES.

New Zealand.—A firm at Hawera, controlling a lighting system there (three-phase alternating, 50-cycle; high tension 3,500-volt; low tension 220/230 light, 380/400 power), desires to get into touch with United Kingdom manufacturers of motors, transformers, lamps, fittings, and switchgear. The firm is also prepared to act as agent for United Kingdom manufacturers of all classes of engineering material.—*Board of Trade Journal.*

The Business Names Act.—Mr. James Martin, chairman of the Parliamentary and Commercial Law Committee of the London Chamber of Commerce, writes as follows:—

May I seek the hospitality of your columns for the purpose of calling attention to the obligation imposed by the Registration of Business Names Act on shopkeepers and other tradesmen, and, in fact, on everyone carrying on a business or profession in this country (except limited liability companies and other corporations)?

This Act provides that on and after March 21st next, all persons carrying on business in this country must trade under their own true names or else must be registered.

The object of the Act is to enable everyone to know with whom they are trading, and if persons are trading under their own names, with no additions except their Christian name or names (or the initials thereof), it is not necessary to register; but if anything is added to the true name, or if a business is carried on under a fancy title, registration must be effected between February 21st and March 21st, on pain of heavy penalties.

A simple instance will serve to show what is required. If, for instance, John Smith owns a business, he may trade as "John Smith" or "J. Smith," and need not register; but if he trades as "Smith & Co.," or adopts a fancy title, such as "The General Drapery Stores," registration must be effected. And in addition to registration, all business letters, trade catalogues, trade circulars and showcards which are issued or sent to any person in any part of His Majesty's Dominions, must show, in legible characters, the true name, or names, of the proprietors of the business, and the present nationality, or the nationality of origin, if other than British.

The individuals and business firms who are not trading under their own name, or names (with no additions thereto), are liable, if not registered by March 21st next, to a penalty up to £5 per day for every day of the offence, or if such individual, or firm, enters into a contract while not registered, such contract cannot be enforced by the law if the other party should want to get out of it. It is also open to any private individual to set the law in motion against a defaulter, except in regard to Sec. 18 (publication in trade catalogues, &c.), where the consent of the Board of Trade must be obtained. It is understood that the forms for registration will be obtainable on and after February 21st, from the principal Post Offices, and the offices of the Registrar for England and Wales are at 39, Russell Square, W.C.

The British Industries Fair.—The third British Industries Fair is now open at the Victoria and Albert Museum and the Imperial Institute. In spite of the restrictions imposed by the war, it is larger, both from the point of view of the number of exhibitors and from the area covered, than it was last year. The Toy Section is in the Imperial Institute. The Pottery and Glass Section and other Sections are in the Victoria and Albert Museum. From the point of view of the number of exhibitors, the Toy Section is the strongest section in the Fair.

In the Glass Section there is an interesting exhibit showing the advance which has been made in the manufacture of chemical glass. No fewer than six firms are showing chemical glassware which was before the war almost entirely manufactured abroad. The China Section, too, contains specimens of laboratory porcelain, an almost exclusively German product previous to the outbreak of war.

The Fair, which will be open from 10 a.m. to 6 p.m. each day, will close on March 9th.

The following are selections from the exhibits announced in the Official Catalogue:—

Messrs. Anglite, Ltd., 68, Cowcross Street, London, E.C., exhibit "Anglite," a substitute for "Galalith," a German production, suitable for electrical fittings and insulating materials, telephone accessories, &c.

The British Ever-Ready Co., Ltd., of Hercules Place, Holloway, N., show their dry cells and batteries, accumulators, pocket lamps, torches, hand lamps, reading lamps, and other electrical specialities.

The British Glass Wool Co., of 134A, Holloway Road, N., exhibit glass wool for the electrical trade, glass fibre, commutator cleaners, &c.

Messrs. Doulton & Co., Ltd., of Lambeth, exhibit chemical laboratory porcelain.

Duroglass, Ltd., of 14, Cross Street, Hatton Garden, E.C., show chemical and laboratory and other glassware.

The Edinburgh and Leith Flint Glass Co., of Norton Park, Edinburgh, exhibit bulbs, tubing, and rods for electric incandescent lamps, black vitrite for electric lamp cap filling, &c.

Mr. P. Hayman, of 8, Long Lane, E.C., shows electrical toy specialities.

Messrs. Icknield Glass Works (Oslers), Ltd., of Birmingham, exhibit electric lamp bulbs, electric light shades, &c.

Messrs. W. A. & R. J. Jacobs, Ltd., of 94, Leonard Street, Finsbury, E.C., display their electric pocket lamps.

Messrs. Molineaux, Webb & Co., Ltd., of Kirby Street, Ancoats, show electric light and arc lamp globes and shades.

Messrs. John Moncrieff, Ltd., North British Glass Works, Perth, show engineering and laboratory glassware, miners' lamp glasses, and glassware for electrical purposes.

The Pytram Manufacturing Co., of Dunbar Road, New Malden, show electric light fittings, advertising novelties, &c.

Messrs. H. G. Richardson & Sons, of Stourbridge, exhibit glass electric fittings.

Messrs. Ward & Goldstone, of Springfield Lane, Salford, have an exhibit of their electric pocket and hand lamps, portable lamps, batteries of many types, model motors and dynamos, and electrical novelties, for all of which they are so well known to our readers.

Messrs. Thos. Webb & Sons, Ltd., of Stourbridge, in addition to many lines of glassware, show electric light standards, candlesticks, &c.

The Wood Bros. Glass Co., Ltd., of Barnsley, shows scientific and laboratory glassware, electric bulbs, flash lamp lenses, X-ray bulbs and tubing, &c.

Trade Announcements.—Messrs. Booth & Bomford, Ltd., announce that their new address, following the fire, is 21, Castle Street, Cardiff. Telephone 1466; telegrams: "Induction."

The New Switchgear Construction Co., Ltd., recently registered, has established works and offices at Sutton, Surrey, on a site immediately adjoining the L.B. & S.C. Railway, and close to Sutton Station. The premises are especially laid out for the erection of large power switchboards, and the machine tool equipment is quite modern. The buildings and site will admit of considerable extensions. The directors of the company are well-known business men and engineers, being Mr. C. E. Cleeves, a South Wales colliery owner; Mr. James Hall, for a number of years manager of the switchgear department of the Union Electric Co., Ltd., and lately general manager of the Switchgear Construction Co., Ltd.; and Mr. W. Walter Hughes, an electrical and mining engineer of wide experience, who will act as consulting engineer to the company. The company has acquired the business of the Switchgear Construction Co., Ltd., of Park Street, Southwark, London, S.E., from the Controller appointed by the Board of Trade, and will specialise in the production of high, medium, and low-pressure A.C. and D.C. switchgear, oil switches, and circuit-breakers, instruments and cognate accessories for the class of gear referred to. The high-tension gear is of designs which have been standardised, and is already well known, it having been given considerable vogue by the Union Electric Co., Ltd. The gear complies in detail with the official regulations as to the use of electrical energy in mines, factories, and textile mills. The new company is entirely British in its capital, directorate, and staff, and the heads of the firm have had lengthy experience of switchgear practice. The company is making special arrangements for the development of its export business.

Dissolutions and Liquidations.—Telephone Development Co., Ltd.—This company is winding up voluntarily. A meeting of creditors is called for to-day, at 22, Broad Street Avenue, E.C. Creditors should send particulars of their debts, &c., to the liquidators (Messrs. J. E. Kingsbury and A. Anns), by March 19th.

Wheatley Kirk, Price & Co., valuers, engineers, &c., 46, Watling Street, London, E.C.—Mr. E. A. Sherley-Price has retired from the firm. The business will be continued by Messrs. Henry Sherley-Price, J. Place, Horace Sherley-Price, and M. H. Cutler.

Fire.—A fire at the works of Messrs. C. Horne & Co., electrical engineers, Middlesbrough, last Friday, caused damage estimated at £1,000.

Bankruptcy Proceedings.—Whitehouse, J. R., Golder's Green, managing director of an electrical engineering company. Application for discharge refused on January 23rd, at Barnet Court, on the ground that the bankrupt's assets are not of a value equal to 10s. in the £ on the amount of his unsecured liabilities, and the Court being of opinion that the debtor's conduct during his course of trading has been most improper.

Catalogues and Lists.—Power Plant Co., Ltd., West Drayton, Middlesex.—Catalogue P84 (32 pages), containing full particulars, including technical notes, diagrammatical tables, price tables, weights, code, &c., of their turbo pumps with patent diffuser.

General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Leaflet L2,092, giving particulars and prices of electric bells for use on power circuits.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham. —Postcards Nos. 654 and 655, giving diagrams relating to their industrial lighting reflector fittings for workshop and office lighting, also prices of same.

"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W.—A collection of advertising leaflets, giving prices and particulars of their drawn-wire lamps, traction, motor-car, candle-type, sign, and flashlight lamps. Trade buyers can have quantities overprinted with their own names, for use as correspondence enclosures, &c.

Messrs. Hart & Co., of Bonnington Works, Newhaven Road, Edinburgh, have sent us a large hanging calendar (monthly slips), the upper half of which is a coloured picture, "In the Good Old Days."

LIGHTING AND POWER NOTES.

Accrington.—Price Revision.—The Electricity Committee has decided to increase the flat rate for lighting from 4·8d. to 5d. per unit; for heating, from 1·2d. to 1·3d.; and to those who are on the rateable value tariff, the price of current per unit will be increased from 6d. to 7d. These charges are subject to 2½ per cent. discount. For power purposes there is to be an all-round increase of 10 per cent.

Australia.—Hydro-electric Proposals.—The report of Mr. de Burgh, engineer-in-chief for rivers and water supply, on the proposal to utilise the Murrumbidgee river at Barren Jack for hydro-electric and irrigation purposes, points out that 1,460 kw. could be made available continuously, providing over nine million units per annum within a radius of 100 miles, within which area a number of towns are situated. The proposal would facilitate electric pumping for water supply, and thereby save the cost of fuel for steam pumping, which fuel has to be conveyed from Sydney. The estimated cost of constructing a power house, with transmission lines and step-down transformers, to five towns, would be £100,000; the annual working and capital charges would be £9,095, while the revenue estimated to be derived from the sale of 3,600,000 units for power and light would be £11,686, leaving a direct profit. It is considered that there would be no difficulty in disposing of the remaining energy in towns in the area, and that a considerable saving of fuel from the State's coal reserve, or of timber, which is being used as fuel, would result.—*Sydney Morning Herald.*

Batley.—Minimum Charges.—The Electricity Committee has decided to impose the following minimum charges for the supply of electrical energy, exclusive of meter rents, as from April 1st next:—Lighting, 25s. per annum; power, £2 13s. 4d. per annum; lighting and power, £2 13s. 4d. per annum.

Bolton.—Linking-up.—A conference of representatives of electricity works in Lancashire was held at Bolton, last week, to discuss the linking-up of such undertakings. Another conference was to be held at Manchester, last Friday, to consider inter-action with a view to the better use of electricity in Lancashire.

Colchester.—Proposed New Power Station.—The T.C. has decided to prepare a scheme for a new generating station at Hythe, and to ascertain the cost of a motor-alternator for use at the power station, and of a main from the station to the shipyard of Messrs. Rennie, Forrestt, Ltd.

Continental.—Russia.—The Council of Ministers has approved two propositions for the supply to Petrograd of electricity generated by the Finnish waterfalls. It is proposed to use the smaller Imatra waterfall; at the same time, it is necessary to arrange for the expropriation of private interests that would interfere with the carrying out of the scheme. For the hydro-electric construction an assignment of 32,000,000 roubles is asked for, and it is intended to complete the work in 1918. A special Government Waterfall Committee is being formed, subject to the Minister of War as president of the Special Defence Council; the Council of Ministers has approved the proposition of the Imperial Finnish Senate to obtain for the Finnish Treasury the expropriation rights of the Vallinkoski waterfalls. The Finnish Senate proposes to use the power of these falls for the electrification of the Finnish railways and the transmission of electricity to Petrograd.

Italy.—The Italian Government has granted to the Società per la Forze Idraliche della Silla water-power concessions in the upper valleys of the rivers Neto, Arno and Ampollino, for irrigation and electric supply purposes. The concession is for 60 years, when the works, &c., revert to the State; the company undertakes to supply energy for working the Calabro-Lucanno railway, and to produce 20,000 h.p., the estimated cost of the scheme being 70,000,000 lire. —*B. of T. Journal.*

Dungannon (Co. Tyrone).—A public meeting has been held to support a scheme by Mr. John Cunningham, an ex-member of the Urban Council, for lighting the town by electricity.

Gorey.—E.L. Scheme.—A syndicate is being formed at Gorey (Ireland) for the purpose of lighting the town by electricity.

High Wycombe.—Street Lighting.—The Electricity Co. has issued a writ against the T.C. for the sum of £1,290, claimed to be due to it under the lighting contract for the year ended December 31st last. The action is to be defended.

Hull.—Loan Sanction.—Sanction has been received from the L.G.B. for the borrowing of £60,000 for extensions of the electricity undertaking. Of the total amount, £30,000 is for new mains and £15,000 for a sub-station.

Huddersfield.—Year's Working.—The Corporation electricity department made a gross profit for the last financial year of £24,651, as against £21,610 in the previous year; and after allowing for the usual capital charges, &c., £2,200 is applied to relief of rates and £1,899 carried to the depreciation fund, which amounts to £10,569—of which £10,000 is invested in War Loan.

India.—The official opening of the electric power station of the United Provinces Electric Supply Co., at Lucknow, took place on January 17th, his Honour the Lieut.-Governor performing the ceremony. Owing to the war, it has not been possible to obtain the delivery of the large engines ordered, but a small supply will be available from the auxiliary plant and battery for the use of the public. In order to meet the anticipated demand, the company has purchased two second-hand plants which were available in Calcutta; each of these is 200 kw.—*Indian Engineering.*

Kilmarnock.—Year's Working.—The annual accounts of the Corporation electricity undertaking show that 5,026,000 units were sold during the year ended May 15th last, as compared with 2,629,000 in the previous year; of these, power absorbed 4,233,000 units, as against 1,933,000 units in the previous year, lighting and traction units also showing a small increase. As shown in the description which appeared in our columns last June, the Kilmarnock undertaking now comprises a very large tract of country outside the borough, served by 11,000-volt, three-phase transmissions, and a considerable load is developing, mainly for power supply. The plant capacity has risen from 3,030 to 5,530 kw. in the year; the rotary sub-station plant from 800 to 1,550 kw.; and the transformer sub-stations from 10 of 1,315-k.v.a. capacity to 25 of 4,120-k.v.a. capacity. The total h.p. of motors supplied increased from 4,127 to 7,314, of which 2,375 h.p. is in the extended area. The maximum load for power and light was 2,400 kw., and for traction 245 kw. During the year, 14,285 tons of coal (at 8s. 7d.) per ton) were used, as against 8,237 tons (at 4s. 2d.), and the average coal cost rose from ·157d. to ·293d. per unit sold, the load factor having improved from 21·5 to 24·3 during the year. The financial results, briefly, were a total revenue of £22,299 (the average price received for the whole supply being roughly 1d. per unit); total working costs, £12,266 (·585d. per unit sold), and a gross profit of £10,033, as compared with £8,282 in 1914-15. After meeting interest and loan charges, the net profit was £3,342, as against £3,726 in 1914-15. The reserve fund in hand amounts to £10,338, and the depreciation account to £3,726.

Leicester.—Price Increase.—The Electricity Committee has decided to increase its charges for electricity for power purposes by 15 per cent. on the existing charges, and the charges for electric light supply from 4d. and 4½d. per unit to 5d. and 5½d. per unit. The total number of customers connected to the power supply mains from the Lero station is 292. The total h.p. installed on consumers' premises at the present time is 11,100 h.p., which shows an annual net increase of 22 per cent.

Loughborough.—Plant Extensions.—The T.C. has decided to apply to the L.G.B. for sanction to the borrowing of a loan of £27,225 for proposed extensions at the electricity works, being part of a large scheme which it is estimated will eventually cost the town £50,000.

Mexboro'.—Plant Extensions.—The Council's electricity works have been twice enlarged since they were erected, and a further scheme of extension, at an estimated cost of £10,000, is at present under consideration.

Norwich.—Proposed Loan.—The T.C. has decided to make application to the L.G.B. for sanction to the borrowing of £3,500 for the construction and equipment of the King Street sub-station.

Tasmania.—Mr. J. H. Butters, manager of the Government Hydro-electric Department, has just finished a tour of inspection of the King River, with a view of determining its suitability for the generation of hydro-electric power for the Mount Read Roseberry mines, a new company under the control of the Mount Lyell Co., which is establishing large metallurgical works at Zeehan for the treatment of the zinc and lead ores of the West Coast. Mr. Butters states that the scheme would generate about 23,000 h.p., but surveys which were to be carried out might reveal greater sources of power.—*Melbourne Age.*

According to the *Melbourne Age*, it is officially stated that the Mount Lyell Co.'s officers have found an almost ideal scheme for generating hydro-electric power on the King River, which will give approximately 40,000 H.P. The catchment area is over 200 square miles.

West Ham.—The L.G.B. has informed the T.C. that as the Ministry of Munitions does not consider the proposed electrical machinery necessary for war requirements, it is unable to give sanction to a loan for it. The L.G.B. is to be asked to reconsider the matter.

TRAMWAY and RAILWAY NOTES.

Accrington.—Fare Increases.—The Tramways Committee has recommended the T.C. to increase the fare on the Haslingden section from 3d. to 4d., and to discontinue the penny return fares for workpeople, the twopenny return fares to remain as at present.

Argentina.—The Anglo-Argentine Tramway Co. has presented a petition to the Chamber of Deputies asking that it should be excepted from the operation of the new law creating a 5 per cent. import duty on articles hitherto imported duty free, so far as effects the construction of its underground lines and the surface lines connected therewith. The company points out that its underground system was projected on the basis of cost prices of articles, free of duty, and submits that it would be unjust to place this burden upon the later stages of the construction. Moreover, the Tramway Co. is exempted from all national taxation, and also the falling off in receipts during the past two years would make the projected tax fall very heavily upon it.—*Review of the River Plate.*

Australia.—The proposed expenditure on railway works in Victoria during the current financial year includes £775,000 for the electrification of the Melbourne suburban lines, excluding the construction and structural alterations of rolling stock.—*Tenders.*

Bingley.—On the recommendation of the Electricity and Tramways Committee, the Council is arranging to interview the Keighley authorities with regard to facilitating the linking-up after the war of the Keighley tramways with the Bradford tramways, which extend through Bingley to Cross Flatts.

Blackburn.—The receipts on the Corporation Tramways for the past 11 months were £57,901, or £1,363 below those of the previous year. The recent increase in fares has made little difference in the number of passengers, but has increased receipts considerably.

Blackpool.—The traffic returns from April 1st last show receipts of £87,727, an increase of £13,268 on the previous year, and over £2,000 more than in the record year of 1913.

Brighton Railway Electrification.—The chairman mentioned at the company's annual meeting that the contractors for the electrification were proceeding as well as could be expected under the present conditions. Certain widenings were required, and they proposed to proceed with them as rapidly as possible, so that greater use might be made of electrical working when the opportunity occurred.

Burnley.—The Tramways Committee has decided, owing to reduced income, to recommend the Council to abolish ordinary discount tickets and the periodical tickets issued to students and apprentices.

Hyde.—The Joint Tramways and Electricity Board has decided to support the Hyde petition against the Ashton Corporation Bill.

Kilmarnock.—Year's Working.—Published data for the year to May 15th, 1916, shows that 2,412,087 passengers were carried and 275,349 car-miles run. The revenue amounted to £8,865, and after meeting working expenses (about £1,000 in excess of the previous year) and providing for interest and loan charges and £1,160 to depreciation, there was a net deficit of £3,064, as against £2,377 in the previous year. Unlike many other undertakings, the revenue showed only a slight increase, but the percentage of operating expenses to receipts increased from 79·6 to 87·3.

North-Eastern Railway Electrification.—Presiding at the annual general meeting held at York, last week, Lord Knaresborough stated that they had now had more than a year's experience of operating the Newport-Shildon mineral line by electricity, and although the accounts for cost of construction were not yet complete, they were satisfied that the venture would justify a charge of £100,000 against capital.

North-London Railway Electrification.—Lord Rathmore, presiding at the annual meeting of the company, referred to the progress of the electrification of the line which formed part of the large scheme of the North-Western Co., mentioning that the falling off in passenger traffic had been arrested, and until fares were raised and services restricted, there had been increases week by week.

North-Western Railway Electrification.—Speaking at the annual meeting of the company, Sir Gilbert Claughton mentioned that arrangement had now been made for a through service of electric trains from Watford to the Elephant and Castle, using tube rolling stock. The Broad Street-Richmond electric services were started in October, and gave promise of a return of the large passenger traffic which that line formerly enjoyed, but they could not look forward to a complete fulfilment of their hopes until the complete scheme was in operation.

Oldham.—The local Tramways Committee has been informed by the Manchester Tramways Committee that it cannot put any additional cars on the Manchester to Oldham line, owing to the scarcity of skilled labour.

Paraguay.—The employés of the tramway company of Asuncion are again on strike, as are also those of the electric power station. The city has been without electric light. The strike movement threatens to spread to other industries.—*Review of the River Plate.*

Rochdale.—The Tramways Committee has declined an application from the female conductors for a war bonus, leaving the latter to apply to the Committee on Production if they think fit.

South-Western Electrification.—At the annual meeting of this company, Mr. Hugh W. Drummond stated that although the final accounts had not yet been settled, the actual cost of the portion of the electrification scheme carried out would amount approximately to £1,365,000. During the whole of the year their increased revenue from local passengers in the electrified area was £77,000. The additional maintenance and working expenses due to electrification were £120,000, and the saving in locomotive expenses owing to the discontinuance of the steam trains was £73,000. In the first year of electrification a profit had therefore been secured of £30,000, after charging revenue with the necessary amount to provide for the replacement of the electrification machinery and equipment. The experience of the electrified portion of their suburban lines had been, in every sense, satisfactory.

U.S.A.—Extension of Milwaukee Electrification.—The directors of the Chicago, Milwaukee and St. Paul Railway are about to electrify two additional engine divisions, extending eastward from Seattle to Orthello, about 220 miles, and crossing the Cascade Mountains on to the plain in the eastern part of the State of Washington.

Across the plain, 200 miles away, is the western extremity of the original 440-mile electrification of this company, at Avery, Idaho. For the present this level intermediate section is to be steam operated; ultimately, however, it is proposed to electrify the whole western end of the system to the Pacific, a distance of nearly 900 miles.

According to Mr. Goodnow, assistant to the president, the new electrification is being undertaken because of the phenomenal success of the electric zone already completed, the outstanding feature of which is the ease with which heavy freight trains are handled on the mountain grades. Five freight trains of about 60 cars each are moved daily each way across the mountains by the electric locomotives, and it is estimated that four hours' time is saved by each train on each 100 miles of road.

The surveys for the new work have been made and similar equipment will be provided, the line operating on the 3,000-volt direct-current system.

The Great Northern Railway, St. Paul, Minn., is arranging to construct a 120,000-H.P. hydro-electric plant at Lake Chelan to supply energy for operating its Cascade division.

Owing to the shortage of available power from the Niagara plant, the International Railway, Buffalo, has had to temporarily suspend service on its Niagara Falls local lines for several hours a day.

West Ham.—At a conference between representatives of the L.C.C., West Ham, Leyton, and East Ham Councils, a new scale of fares was arranged to come into operation on through-running routes on March 1st, 1917. Female labour is to be engaged to undertake car cleaning during the day. The Tramways Committee has adopted a report from the electrical engineer upon the condition of the machinery at the generating station, and suggesting that further converting plant be installed, and certain alterations in the traction supply network be made to enable a larger proportion of the work to be dealt with through the medium of the general alternating current supply.

TELEGRAPH and TELEPHONE NOTES.

Australia.—On December 20th, Mr. Justice Higgins gave final judgment in the claim of the Australian Postal Electricians' Union against the Postmaster-General and the Public Service Commissioner. He said he had substantially adopted the provisions of the more recent linemen's award in order to give officers the benefit of acting in higher positions, whether those positions had occupants or not, and to give them the benefit of the increments as well as the minimum salary for higher officers. He had been frustrated by Section 12 of the Public Service Act of 1915 in his endeavour to prevent the appointment of adults of 30, 40, or 50 years as junior mechanics. There were no fewer than

167 successful candidates for appointment as junior mechanics, and only 23 of these were under 21 years of age. This seemed to him to be a scandalous abuse of the position of junior mechanics, which was primarily meant for boys.—*Sydney Daily Telegraph.*

Calcutta.—The Director-General of Posts and Telegraphs has decided to open public telephone call offices at local post and telegraph offices in Calcutta. Should the system be found to pay its way, it will be extended to other places in the city. The charge will be annas 2 per connection of three minutes' duration.—*Indian Engineering.*

New Wireless Stations.—A wireless station has been erected at Cape Juby, W. Africa, which will be in communication with Spain *viâ* the station at Teneriffe. Stations are also to be installed at Arauca and Orocue, in Colombia, the former communicating with Venezuela.

Persia.—Telegrams may now be forwarded to the undermentioned places at the rates stated :—Abadan, Persia, 2s. 7d. a word ; Koweit, Mesopotamia, 2s. 3d. a word.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 7th. Powell-Duffryn Steam Coal Co. Electrical goods for 12 months. Stores Manager, Aberaman Offices, Aberdare.

March 8th. U.D.C. Annual tenders for cable, meters, joint boxes, electric lamps, &c., for the Electricity and Tramways Department. See "Official Notices" February 23rd.

Australia.—ADELAIDE.—March 28th. P.M.G.'s Department. Telephones, telephone parts, line and battery material, &c. Schedules 444 to 453. See "Official Notices" February 2nd.

MELBOURNE.—March 7th. Council. 1,048 electricity recording meters. See "Official Notices" February 9th.

Barrow.—March 5th. Corporation. Electrical stores for 12 months. Borough Electrical Engineer.

Bedwas (Mon.).—March 8th. Bedwas Navigation Colliery Co., Ltd. Twelve months' supply of electrical goods, &c. Mr. G. Morgan, Secretary.

Belfast.—March 3rd. Electricity and Tramways Committee. Tramway stores, including electrical accessories, cables, lamps, &c. See "Official Notices" February 23rd.

March 14th. Electricity and Tramways Committee. Six or twelve months' supply of stores, including several electrical items, for the Electricity Department. See "Official Notices" Feb. 23rd.

Bolton.—March 7th. Electricity Committee. Materials and stores. See "Official Notices" February 16th.

March 19th. Corporation Tramways Committee. Materials and stores for a year. See "Official Notices" to-day.

Brighton.—March 9th. T.C. Five-ton steam motor-wagon and 3½-ton electric motor-wagon. Particulars from Mr. H. Talbot, Town Clerk.

Burnley.—March 19th. Electrical goods, for the Board of Guardians. Mr. J. S. Horn, Clerk.

Canada.—March 28th. Toronto Electric Commissioners. Synchronous condensers, 5,000, 7,500 or 10,000 K.V.A. capacity. See "Official Notices" February 9th.

Grenada.—March 31st. The time for tendering for the Government electric light and power concession, already announced, has been extended to March 31st.

Harrogate.—March 5th. Corporation. By-product steam boiler plant. See "Official Notices" February 2nd.

Kilmallock.—March 5th. Kilmallock (Co. Limerick) E.L. & P. Co., Ltd. Hydraulic turbine, dynamo and motor booster, battery and switchboard. See "Official Notices" February 16th.

London.—KENSINGTON.—March 8th. B. of G. Six months' supply of electric fittings, lamps, &c. Mr. W. R. Stephens, Clerk, Guardians' Offices, Marloes Road, W.

Londonderry.—March 17th. Corporation. Engine-room stores, carbons, electricity meters, cables, &c., for the Electricity Department. Town Clerk.

Macclesfield.—March 14th. Cheshire County Asylum. Electrical goods for one year. Mr. W. G. F. Tingay, Clerk to the Asylum, Parkside.

Manchester.—March 7th. Electricity Committee. Coal-conveying plant and suction ash plant. See "Official Notices" February 9th.

March 14th. Corporation. Nine 40-H.P., three-phase, slip-ring motors. See "Official Notices" February 23rd.

Rhondda.—March 21st. U.D.C. Twelve months' supply of house-service meters. See "Official Notices" to-day.

Stockton-on-Tees.—March 12th. Stores for the T.C. Electricity Department. See "Official Notices" February 23rd.

CLOSED.

Swansea.—B.C. Tenders for extensions of the plant at the generating station (at an estimated cost of £6,000) :—

Water-tube boiler and accessories.—Stirling Boiler Co., Ltd.
Mechanical draught fan.—Musgrave & Co., Ltd.
Boiler feed pump.—Weir, Ltd.

The Education Committee has accepted the tender of Messrs. Thomas & Evans for electrical fittings for the cookery and laundry departments, at £145.

FORTHCOMING EVENTS.

Society of Engineers.—Monday, March 5th. At 5 p.m. At Burlington House, Piccadilly, W. Paper on "High Tensile Steel *versus* Mild Steel for Reinforced Concrete," by Mr. A. W. C. Shelf.

Institution of Civil Engineers of Ireland.—Monday, March 5th. At 8 p.m. At 35, Dawson Street, Dublin. Ordinary meeting.

Institution of Civil Engineers.—Tuesday, March 6th. At 5.30 p.m. At Great George Street, Westminster, S.W. Paper on "The Commercial Metering of Air, Gas, and Steam," by J. L. Hodgson.

Liverpool Engineering Society.—Wednesday, March 7th. At the Royal Institution, Colquitt Street. Paper on "Some Problems on Railway Curves," by Prof. S. W. Perrott.

Institution of Electrical Engineers.—Thursday, March 8th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Voltage Regulation of Rotary Converters," by Mr. G. A. Juhlin.

Greenock Electrical Society.—Thursday, March 8th. At 7.45 p.m. At 22, West Street. Paper on "Notes on the High-speed Engine," by Mr. S. V. Thorp.

Physical Society of London.—Friday, March 9th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Salford Technical and Engineering Association.—Saturday, March 10th. At 7 p.m. At the Royal Technical Institute, Peel Park. Paper on "Our Aerial Ocean," by Mr. J. Bacon.

NOTES.

The Need for Home Support for British Electrical Industry.—In the course of a paper on "Stores Organisation at Collieries," read before the West of Scotland Branch of the Association of Mining Electrical Engineers at Glasgow, last month, Mr. P. J. SIMS, general manager in Scotland for the General Electric Co., referred to the need for British users to give full support to British manufacturers. According to a report in the *Glasgow Herald*, he said that they never needed that support and assistance more than now. He continued :—British manufacturers were practically debarred from quoting for railway electrification schemes, because British railway companies had almost totally ignored railway electrification. The result was that British manufacturers had had a negligible amount of experience in this class of electrical engineering. How, then, could it be expected that a foreign railway company would entrust a contract to a British manufacturer when the British railway companies had denied the British manufacturers the right to electrify British railways? A similar state of things prevailed in regard to heavy winders. Germany, America, and other countries had developed the electrical winder to a remarkable extent, and that development had only been made possible by the support given by the colliery owners in these countries. In Great Britain heavy electric winders were few and far between. Our manufacturers had not had the experience they ought to have had, and in pre-war days all electric winding contracts of any size for abroad went to those foreign manufacturers who could show winders actually at work. To quote a final instance, he would refer to Britain's position in regard to the steam turbo-generator. The turbine was invented in Great Britain, and the finest turbines to this day were still made in this country, but owing to the extreme cautiousness—to use the most charitable expression—of British municipalities and other supply authorities, we had been left far behind in the manufacture of large machines. The manufacturers could only advance sufficiently fast if they were given the support of the users. The advantages were mutual, for the user benefited by the reliability and efficiency of the plant.

Industrial Policy.—At a meeting of the Swansea Chamber of Commerce a special committee appointed to deal with the question of commercial and industrial policy after the war made a recommendation in order to encourage better relations between Capital and Labour. It suggested that "all factories and industries employing power plant should as far as possible work three shifts of eight hours each daily and, further, that labour generally is entitled to a proportionate share of the wealth it helps to produce. On the other hand, we feel strongly that labour should stop all attempts at restriction of output, that there should be no stoppage of work either to strike or lock-out pending the settlement of any dispute, and that a form of compulsory arbitration should be adopted which would nullify any advantages from a stoppage of work expected by those responsible by means of a National fund contributed to by Capital and Labour, from which the non-defaulting party would be compensated for losses incurred during such stoppage."

The fostering and protection of skilled female labour was also recommended in view of the hitherto unascertained great National asset which the war had disclosed.

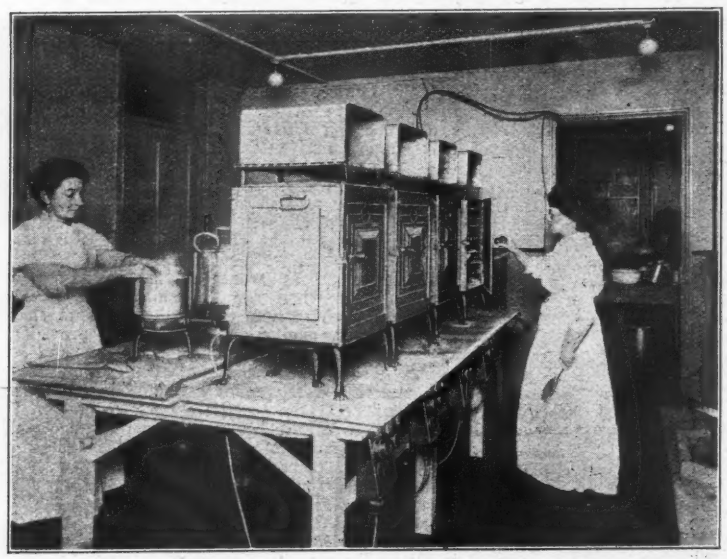
Electric Furnaces.—The needs created by the war have given a great impulse to the use of the electric furnace for the manufacture of steel, and more than 100 have been installed in the belligerent countries. The number actually now existing in the world is 300, while in 1913 there was hardly half that number. The United States constructed 50 last year, and 30 have been installed in England. Italy has made additions, while Germany turned out 130,000 tons of electric steel in 1915 against 90,000 tons in 1914. In France, in the neighbourhood of Limoges, there has been installed a Keller furnace, in which 30 tons of waste are daily converted into high-priced metal. The furnace takes up little room in the car depôts of the tramway company, and by the use of automatic apparatus needs little attention. Its consumption of current is between 700 and 800 KW. per 100 kilos of metal produced. The question, says *Industria é Invenciones*, is of great interest to our country, since, if the electrical undertakings were to study the means of facilitating the installation of electric furnaces, there would be a great development of the iron industry, and more particularly the conversion of scrap and waste into iron and steel.

A Railway Cooking Installation.—As mentioned in a recent issue of the ELECTRICAL REVIEW, the companies operating the Underground group of railways have equipped a luncheon and social club near Earl's Court Station for their female administrative staff, where some 200 meals a day are served; this club was recently opened by Sir Albert Stanley.

Practically the whole of the cooking is done electrically, the kitchen installation consisting of four "Tricity" ovens, each fitted with a hood on the top for simmering, &c., as shown in our view.

Each oven has two circular ribbed type heaters, top and bottom, arranged for two loadings, 250 and 900 watts, each heater being controlled by a "high and low" switch, of the pattern manufactured by Messrs. Lundberg under the British Electric Transformer Co.'s patent for dissimilar metal contacts.

The ovens are mounted on a central table, together with five "Tricity" boiling plates, each with two loadings, 850 and 225 watts, controlled by high-low switches, the boiling plates being used with a fish kettle, bain marie, and other boiling equipment. The main control panels for this equipment are fitted with Zed fuses, switches, and indicating lamps.



Topical] *[Press Agency.*

ELECTRICAL KITCHEN AT THE UNDERGROUND RAILWAYS' CLUB.

We understand that a "Tricity" restaurant type grill, with top and bottom heat, is being added to the equipment. Two other ovens have been temporarily installed of a size suitable for large joints, one being of the Jackson type, and the Jackson Co. has also supplied two carving tables and hot cupboards, one being in the servery adjacent to the dining rooms, also a vegetable boiler with six steamers, and two electric urns. The Jackson equipment is provided with control panels containing Zed fuses, Diamond H switches, and indicating lamps. As will be gathered, the cooking equipment is not yet completed, the demands of the club members having exceeded anticipations.

Y.M.C.A. Canteen Cooking Installation.—On Saturday last a new canteen, administered by the Y.M.C.A., at a well-known engineering works in North London, was formally opened by Princess Victoria of Schleswig-Holstein. The whole of the cooking will be done by electricity, a complete installation for supplying meals to 2,000 employés having been supplied by the British Electric Transformer Co.

Aluminium.—The Ministry of Munitions announces that all existing permits for the sale, purchase, or re-melting of aluminium scrap and swarf are cancelled as from March 1st. Regulations have been issued governing all dealings. Applications for permits should be made to the Director of Materials, A.M. (2), H., Hotel Vitoria, Northumberland Avenue, W.C.

Change of Address.—Queen Anne's Chambers, Westminster, S.W., being required by the Government, the following firms announce that they have secured suitable premises at 25, Victoria Street, Westminster, S.W.:—

Nathan & Allen.
Wardle Engineering Co., Ltd.
Parmiter, Hope & Sugden, Ltd.

Their telegraphic and telephonic addresses are unaltered.

Institution and Lecture Notes.—The Institute of Metals.—A special feature of the forthcoming Spring Meeting of the Institute, to be held on March 21st and 22nd, will be a general discussion on metal melting, a subject which hitherto has received very little attention from the scientific societies. The president, who will preside over the discussion, is Sir George Beilby, F.R.S., the head of the new Government Board of Fuel Research. A series of six communications will be read bearing on all phases of the question of the melting of the non-ferrous metals, whether by high-pressure or low-pressure gas, coke, oil fuel, or electricity. The papers to be contributed include the following:—

"Metal Melting as Practised at the Royal Mint." By W. J. Hocking.

"An Electric Resistance Furnace for Melting in Crucibles." By H. C. Greenwood, D.Sc., and R. S. Hutton, D.Sc.

"Ideals and Limitations in the Melting of Non-ferrous Metals." By Carl Hering (Pa., U.S.A.).

In addition to the metal-melting discussion, several important communications bearing on other phases of metallurgical work will be presented at the meeting, amongst which may be mentioned the following:—

"The General Properties of Stampings and Chill Castings in Brass of Approximately 60/40 Composition." By Owen W. Ellis, B.Sc.

"Aluminium Production by Electrolysis: A Note on the Mechanism of the Reaction." By R. Seligman, Ph.Nat.D.

On account of Caxton House having been commandeered by the War Office, the address of the Institute of Metals will in future be 36, Victoria Street, London, S.W. The new offices are much more extensive and better suited to the purposes of a scientific society than those recently vacated, and include a reading room and library, available to members, as well as a spacious meeting room. The telephone number (Victoria 2320) and the telegraphic address ("Instomet, Vic., London,") remain unaltered.

Particulars of membership can be obtained from the secretary, Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. All candidates for membership whose applications are in the secretary's hands before March 14th will be entitled to take part in the proceedings at the London meeting. Members elected at the forthcoming meeting will have the privilege of membership, not for the usual 12 months, but for the extended period ending June 30th, 1918. The present membership of the Institute is 660—a record total.

The seventh annual May Lecture will be given at the Institution of Civil Engineers, on May 3rd, 1917, at 8.30 p.m., by Prof. W. E. Dalby, M.A., F.R.S., on "Researches Made Possible by the Autographic Load Extension Optical Indicator."

MR. HARRY WEBBER, electrical engineer to the Keighley Corporation, lectured on Saturday evening last before the Keighley Association of Engineers on "Progress in Electric Power Plants," illustrating his observations with lantern slides.

Institution of Civil Engineers.—On Monday, March 12th, at 5.30 p.m., the first of a series of special extra meetings is to be held. The subjects chosen for these meetings are matters of special importance to engineers at the present time, and a discussion will follow each of the lectures. On March 12th, Mr. Edgar Crammond is to lecture (under the Vernon-Harcourt Trust) on "Foreign Trade and its Relation to the Investment of Capital Abroad"; and at the later meetings, the subjects will be:—"Decimal System of Coinage, Weights and Measures," and the "Standardisation of Engineering Materials." Members of the Institutions of Mechanical Engineers, Naval Architects, and Electrical Engineers, and of the Iron and Steel Institute, are invited to attend Mr. Crammond's lecture.

The Engineers' Club.—On Wednesday evening, Mr. Ben H. Morgan, of the Technical Department of the Ministry of Munitions, delivered an address before this club at Manchester on "Dilution of Labour in Munition Works."

Institution of Mechanical Engineers.—At the meeting on February 16th, Mr. Michael Longridge was declared elected president. The vice-presidents were Mr. Dugald Clerk, Sir Robert A. Hadfield, and Mr. Mark Robinson; members of Council, Sir A. T. Dawson, Mr. G. Hughes, Mr. E. Matthews, Mr. D. B. Morison, Sir Gerard A. Muntz, Bart., and Mr. W. Reavell.

Fuel Research.—On the recommendation of its Advisory Council, the Committee of the Privy Council for Scientific and Industrial Research has appointed a Board of Fuel Research. Sir George Beilby will act as Director of the new organisation, and will be assisted by the Hon. Sir Charles Parsons, Mr. Richard Threlfall, and Sir Richard Redmayne, the Chief Inspector of Mines, as members of the Board. By arrangement with the Governors of the Imperial College of Science, the Lord President has retained Prof. W. A. Bone as consultant to the Board. Prof. Bone will continue to hold his chair at the Imperial College, but will abandon all private consulting work while he is connected with the Department of Scientific and Industrial Research.

Proposals for research initiated by the Coal Conservation Sub-Committee appointed in July, 1914, will stand referred to the Fuel Board, to which also will be transferred the material collected by the Fuel Committee which the British Association formed in 1915. The Admiralty and the Ministry of Munitions have also been making tests and investigations on fuel problems, and it is hoped that their work will be co-ordinated with that of the new Board.

The work of the Board will be to investigate the nature, preparation, and utilisation of fuel of all kinds, both in the laboratory and, if necessary, on an industrial scale. Sir George Beilby, with the assistance of his colleagues on the Board, will be responsible for drawing up the schemes of research, and when these have been approved by the Advisory Council and the Committee of the Privy Council, authority will be given him to carry them into effect. In this way he will have the whole weight of the Department and its finance behind him, and since he will have direct access to the Lord President, who is the responsible Minister, there will be no danger of his recommendations lying pigeon-holed among Departmental files.

Development of French Hydro-Electric Works.—The history of the industry whose object is the utilisation of the waterfalls in France represents a struggle against the inadequacy or obscurity of the Civil Code and administrative regulations, followed by a modification which has perhaps hastened the threat of more restrictive legislation. Almost all of these measures were instituted at a remote period when it was impossible to foresee the advantages which engineers would derive from the waterfalls. Nevertheless engineers finally succeeded, aided by well-informed lawyers, in accommodating themselves to situations which were the least favourable in appearance, and individual hydro-electric works have been established of a capacity of several thousands of horse-power on the mere basis of precarious authorisations capable of being revoked. In certain cases the French Administration, by simple decree, has sanctioned important diversions from navigable waterways, all of which legally form part of the public domain. The non-navigable waterways which are subject to the rights of riparian owners have been brought into service through the assistance of obliging intermediaries. In fact, the hydro-electric industry has triumphed over all obstacles and routine; it has become prosperous and is visibly developing at the present time.

The results hitherto obtained have been set forth by the work undertaken by M. de la Brosse in relation to the region comprised between the Rhone, the Alps, and the Mediterranean—the "white coal" region. Two tables have been prepared by this engineer at an interval of six years, showing the remarkable progress which has been made in this period. It is generally estimated that the total power available from the falls of the Alps amounts to 2,000,000 H.P. at low water and over 4,000,000 on the average, the latter representing about one-half of the aggregate power capable of being obtained from the French waterfalls as a whole. The first table indicates that the plant installed in the French Alps for lighting and power purposes, metallurgy, electro-chemistry and traction amounted nominally to 469,835 H.P. in 1910 and 662,545 H.P. in 1916, whilst the works in course of construction represent a further 93,100 H.P. Apart from the extensions already in hand, it is noteworthy that out of the total power installed in 1916 more than 256,000 H.P. were being utilised for electro-metallurgical work and 110,000 H.P. for electro-chemical operations. It is also worthy of note that only works of a combined capacity of 90,000 H.P. are deriving power from public waterways, whilst nine-tenths of the energy produced by works on the public waterways are utilised for the public supply of light and power. It is considered that the disinclination of manufacturers to avail themselves to a greater extent of the public watercourses is due to the fact that hydro-electric works of this kind are more expensive to construct and that the prospect of innumerable formalities with the Administration, which is lacking in resolution through the fear of being suspected of favouring private interests, is not calculated to encourage private enterprise in this direction. It is therefore suggested that legislation should be promoted to facilitate development of the waterways under the designation of public domains and of the non-navigable watercourses in so far as they are still available for that purpose.

Use Solid Wire in place of Small Stranded Cable.—The Cable Makers' Association has recently addressed a letter to the engineers of central stations, pointing out that the Government requirements in small stranded wires are at present so great as to require the use of practically every wire-drawing and stranding machine in the country. Thus the demand for such wires other than for direct military or naval needs entails considerable delay in execution of orders. Many engineers to public authorities and companies insist upon the use of stranded conductors for wires below a specified sectional area, and some prohibit the use of solid conductors entirely. If such restrictions can be *temporarily suspended during the war*, the cable makers will be enabled to put forth the full capacity of their plant for the military and naval needs, and yet meet the requirements of other customers carrying out other essential work. The Association therefore suggests that during the war

No. 18 S.W.G. be used in place of 3/22 S.W.G. or 7/25 S.W.G.,
No. 16 S.W.G. in place of 3/20 or 7/23 S.W.G.,
No. 14 S.W.G. in place of 7/22 and 7/21½ S.W.G.,

and hopes that permission will be given to contractors in each district to use solid conductors as an emergency measure.

In view of the urgent military necessity for restricting the use of small stranded conductors for the present, we feel sure that the Association may safely count upon the patriotic co-operation in this matter not only of station engineers, but also of all users of such materials. In addition to circularising the station engineers, the Association is also advertising the matter in the technical Press.

The Control of the Electric Motor Vehicle Business.—Referring to our leading article on this subject last week, we are sorry to learn that the Agents' Section, Ltd., a body that is associated with the Motor Trade Association, has resolved to follow the line advocated by the Scottish Advisory Council of the M.T.A., and to oppose the Bill which would enable central electricity supply undertakings to store, charge, inspect and repair electric vehicles, the opposition being based, it is stated, on a strong objection to any extension of municipal trading. We note, too, that Electromobiles (Leeds), Ltd., have written to the *Motor Trader* congratulating it on its outspoken leader, adding that they "hope the time is not far distant when the motor trader will take up 'electrics' enthusiastically, and will offer them to his customers for use in their proper sphere, continuing to offer petrol or steam where he thinks these types will serve his clients best. We do not agree that the development of the electric vehicle has been held up for want of charging facilities, but simply for want of knowledge. As soon as it is better known what the electric will do, sales will come readily enough, and the electricity can always be provided when the demand exists."

Linking-up Electricity Works.—The Committee for the Interconnection of Lancashire and Cheshire Electricity Supply Systems informs us that a conference of delegates representing the Municipal and Company Electricity Supply Authorities is to be held in Manchester Town Hall to-day (Friday), at 11 a.m., to consider the proposals set forth in the report of the Committee with regard to the interconnection of electricity supply systems. The conference will be presided over by Mr. G. H. Roberts, M.P., the Parliamentary Secretary to the Board of Trade, and the electricity supply authorities will be represented by about 120 delegates. The report was published in our issue of October 13th, 1916.

Memorial to the late Prof. Silvanus P. Thompson, D.Sc., F.R.S.—The Council of the Finsbury Technical College Old Students' Association has appointed a small Committee to arrange for a memorial to the late Prof. Silvanus P. Thompson. Another Committee has also been formed amongst certain friends of Dr. Thompson and representatives of the scientific societies with which he was connected, to purchase the very valuable scientific library which Dr. Thompson collected. It is proposed to present the library, which is one of the best of its kind in existence, to the Institution of Electrical Engineers, to be accessible to the public on the same conditions as the Ronalds Library. The Committee of Council of the Old Students' Association hopes to raise a sum of not less than £250, and proposes to divide the subscriptions sent to it into two parts—one of these parts to be appropriated to the establishment of a suitable memorial to be placed in the City and Guilds Technical College, Finsbury, with which Dr. Thompson was so long connected, and the other to form a contribution from the Finsbury Old Students' Association to the library fund. Mr. J. E. Raworth, president of the Association, will be very pleased to receive subscriptions, which may be of any amount, and should be addressed to him at 28, Broadway, Queen Anne's Chambers, Westminster, S.W.

Prohibited Exports.—The Supplement to the *Board of Trade Journal* of March 1st contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported from Denmark, France (including Algeria), Italy, Japan, and the Netherlands. The Supplement also contains a list of articles (complete to date) which are prohibited to be exported from the United Kingdom.

Fatality.—On February 21st a labourer was killed by scalding, and another badly injured, through the bursting of a boiler tube at Derby Corporation electricity works.

Inquiries.—The makers of the McClelland lamp-locking device (Patent No. 299/09) are asked for; also makers of electric boot and knife cleaning machines.

Volunteer Notes.—First London Engineer Volunteers.—Headquarters: Balderton Street, Oxford Street, W.—Orders for the week, by Lieut.-Col. C. B. Clay, V.D., Commanding :—

Monday, March 5th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill, 6.30—8.

Wednesday, March 7th.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1.

Thursday, March 8th.—Platoon Drill, Platoon No. 7. Ambulance Class by M.O., 6.30. Signalling Class.

Friday, March 9th.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Recruits' Drill, 6.25—8.25.

Saturday, March 10th.—N.C.O.'s Class, 2.30; Company Commander Castell, "Knots and Lashings."

Sunday, March 11th.—Special work at Bombing School. Parade Clapham Junction Station (City & S.L. Tube Railway), 9.45 a.m. Uniform, haversacks, water bottles. Mid-day rations to be carried.

(By order), Macleod Yearsley, *Adjutant.*

South African Electrical Supplies.—In recent issues of the *South African Mining Journal* we read the following :—

"There has been quite a lot of buying of electrical material, more particularly cables and megohm wires, also small motors, as well as the general run of electrical fittings other than the ordinary lighting lamps, of which there are ample supplies in the town. The British Government has put a bar on the exportation of anything containing copper, and as this metal predominates in electrical materials, a sudden hurry occurred to secure stocks. The Public Works Department requisitioned for some miles of cables, also the Premier Diamond Mine came forward with substantial orders for electrical fittings, wiring, &c. The Municipalities, Mines, and Railway Department have been purchasing rather freely, as well as the Messina Copper Mine in the Northern Transvaal. Delagoa Bay and another couple of coast towns came into the market in a lesser degree. The demands created quite a lively diversion in the direction of activity amongst the electrical merchants.

"The Japanese supplies are coming forward very regularly, and so keeping up our already ample household stocks. The American goods are anything but regular of late, and the British must also be classed in the same category. The electrical jobbing work is very much on the poor side, as property owners seem very loath to spend any money whatever, except on work that cannot be postponed."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Bingley District Council has advanced the salary of Mr. Pedley, the electrical engineer, by £25 per annum.

Mr. C. A. Frost, assistant engineer, has been appointed, at a commencing salary of £300 a year, to succeed the late Mr. Le Feuvre as borough electrical engineer at Bexhill-on-Sea.

The Mexborough U.D.C. has advanced the salary of Mr. J. B. Feltham, the electrical engineer, by £50 per annum.

General.—The many friends of Mr. W. Crawford, who has been so long associated with Messrs. Belliss & Morcom, will learn with much regret that he lies seriously ill in Cardiff. For some time his friends passed a very anxious time, but the latest news is that he shows distinct improvement. There is no man in the country who has done more to establish the name of Messrs. Belliss & Morcom as a household word among engineers, whether in municipal or industrial life, and all these will join in wishing Mr. Crawford a speedy and complete recovery.

Sir Maurice Fitzmaurice, C.M.G., late chief engineer to the L.C.C., has been appointed chairman of the Committee to control canals taken over by the State.

Mr. W. H. Sisson, who for the past 10½ years has been engineer to the Kearsley Spinning Co., Ltd., Stoneclough, has been appointed engineer to the Falcon Spinning Co., Ltd., Bolton. He was formerly managing engineer of the Witney Electric Supply Co., Ltd., and foreman for Messrs. Dick, Kerr & Co., Ltd., and for the Mersey Docks and Harbour Board.

Messrs. V. Lindop and M. C. Mattinson have been appointed local directors of the River Plate Electricity Co. Mr. B. C. Wilson has been appointed manager and engineer of the La Plata station of the same company.—*Review of the River Plate.*

Mr. W. N. Y. King has been appointed assistant (civilian) inspector of munitions.

Roll of Honour.—Captain Eric Sutherland Phillips, 8th Battalion Border Regiment, of Rugby, died of wounds received in action on February 21st, aged 22 years. At the declaration of war, Captain Phillips was a pupil in the works of the British Thomson-Houston Co., Ltd., Rugby. He volunteered for service, and enlisted as a private in September, 1914. His Colonel writes :—

"He was a most excellent young officer, always willing and cheerful. During the time when he was in charge of the Machine Gun Detachment of the Battalion he did very good work. He was very plucky under fire, and a very good leader. We shall all miss a cheery, plucky comrade, and a great favourite in the Battalion."

Captain Phillips was the son of Mr. J. A. Phillips, assistant manager of the B.T.H. Co.'s supply department at Rugby.

Private J. Stamper, Northumberland Fusiliers, reported missing, was in the electrician's department of Messrs. David Brown & Sons, Ltd., gear cutters, &c., Lockwood.

Private R. Fletcher, of the Machine Gun Corps, who has been killed in action, was employed by the Lancashire Dynamo Co., Trafford Park.

Private A. Lord, of the East Lancashire Regiment, who has been killed in France, aged 39, was employed in the Bacup Corporation electricity department.

Private L. Walters, who has fallen in action before Kut, was for several years in charge of the electric light plant at Wood Norton, near Evesham.

Lance-Corporal P. B. Pettitt, of the Manchester Regiment, who is in hospital in Devonshire, suffering from wounds, was employed by the Lancashire Dynamo Co., Trafford Park.

Sapper F. C. Shenton, of the R.N. Division, has been killed at the age of 36 years. He was formerly employed as an electrician at the Hyde Road depôt of the Manchester Corporation Tramways.

The *London Gazette* for February 27th contained the following :—"London Regiment.—Second Lieutenant (Acting Major) H. C. Sparks, D.S.O., M.C., is seconded for duty as Assistant Director of Labour. January 2nd, 1917."

At a meeting of the Barrow Corporation electricity employés at the Town Hall, on Monday, occasion was taken to mark the honours won by Company Sergeant-Major R. A. Williams, who had received the Military Cross for gallantry in the field. Ald. Smith presided. The Mayor of Barrow, on behalf of the employés, presented Company Sergeant-Major Williams with a spirit tantalus and a case of carvers. His Worship said that Sergeant Williams commenced with them as a labourer in 1902, and became a jointer in 1909. He joined the Colours in September, 1914, and worked his way up to company sergeant-major, and now he was about to proceed to a cadet training school with a view to taking up a commission. He had won the Military Medal, which was a very high honour for a non-commissioned officer, by taking charge of his company after all the officers were casualties, and keeping control until ordered to retire.

Obituary.—Mr. J. R. Preece.—We regret to record the death, which occurred at Kensington on February 25th, at the age of 73 years, of Mr. John Richard Preece, C.M.G., youngest brother of the late Sir William Preece. In the year 1870, Mr. Preece went out to join the Imperial Persian Telegraphs as assistant engineer, and he resigned that office to join the Consular Service there. He afterwards became H.B.M. Consul-General at Ispahan, Persia. The deceased gentleman many years ago read a paper on the Persian telegraph system before the Society of Telegraph Engineers in London.

Ald. J. Brodie.—The funeral of the late Ald. J. Brodie took place at Blackpool Cemetery on February 22nd. The remains were borne to the grave by six inspectors and timekeepers of the tramway department. The staffs were largely represented, and in the funeral procession were three cars driven by motormen and conducted by women with crepe-banded sleeves. Wherever cars were encountered on the route they came to a halt while the cortége passed, and at Foxhall Square the staffs of the electricity works and the car men stood reverently to attention.

POWDERED COAL BOILER FURNACE.

In our issue of November 3rd last, we referred at some length to the subject of powdered coal as a fuel for boiler firing. As mentioned then, one of the difficulties has been to find a suitable form of furnace, which, while allowing of complete combustion, would at the same time withstand the very high temperatures resulting, which with ordinary construction would melt down the furnace linings.

In this connection, a letter in the December *Journal* of the American Society of Mechanical Engineers, from Mr. C. L. Heisler, of Schenectady, describes a most simple form of furnace (fig. 1) which has been in continual and regular service under a boiler at the American Locomotive Co.'s works since March, 1915. The furnace is believed to be entitled to a world's record for low cost of maintenance; the CO_2 rarely drops below 16 per cent., and is oftener above 17 per cent.

Evaporative tests show that a materially higher evaporative efficiency is obtained than from a duplicate Franklin boiler fired by mechanical stokers and supplied with feed water at the same temperature, also the powdered coal fired boiler responds much more readily to increased steam demands, and an ordinary fireman provides all the necessary attendance.

With a previous experimental furnace under the same boiler, the brickwork failed to withstand the temperature, and there were excessive accumulations of hard slag in the

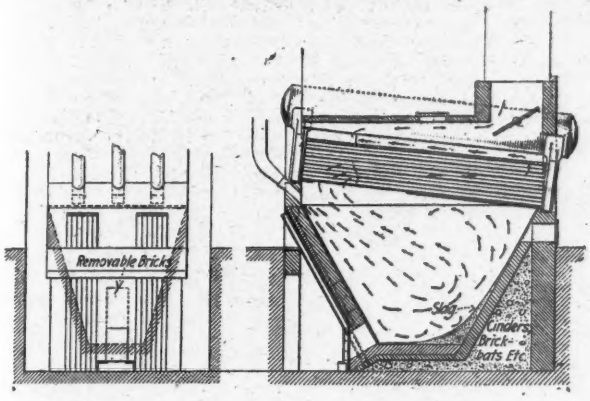


Fig. 1.—Powdered Coal Furnace at the American Locomotive Works.

furnace bottom and deposits of unburned products round the tubes.

Several years ago Mr. Heisler concluded that the only way to prevent the destruction of vertical walls and arches in powdered-coal furnaces was not to have them, and substitute incandescent ignition surfaces formed by simple outwardly inclined walls which would be automatically maintained by a coating of protecting slag. The furnace now in use has been in continual service for 18 months without a single repair expense on the hopper-shaped furnace walls. These walls are coated with about 1 in. to 3 in. thickness of slag, and are seemingly in as good condition as at the time they were built. The fire pit openings are covered by temporary iron plates.

The three original inlet tuyeres are yet in service, and apparently may be in service for another year; they consist of three ordinary wrought-steel pipe nipples, 10 in. in diameter and 24 in. long, which, when originally installed, protruded downwardly a few inches into the furnace. After a short time the inner ends burned away and gave them their present form.

Powdered coal is fed by a screw feeder from a hopper into the air blast at a point about 3 ft. away from the furnace tuyeres. This distance may be very much more, but not less, for the purpose of thoroughly mixing the coal with a properly proportioned air blast that passes downwardly through the tuyeres at a pressure of ¼ to 1½ oz.

A plurality of tuyeres and feeders is essential to good combustion, so as to reduce the effects of imperfect feeding of any one feeder or of flooding through a feeder from slips in

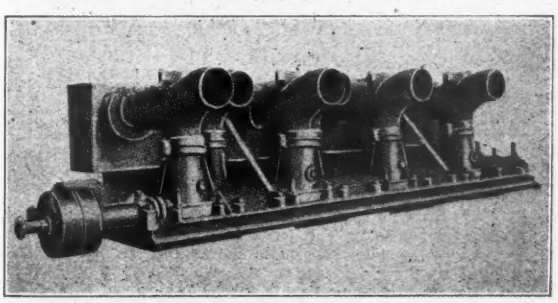


Fig. 2.—Powdered Coal Feeder Set.

the coal hopper. No particular form of feeder is necessary for successful operation. Fig. 2 shows a feeder set with eight outlets.

There is a very slight air inlet suction at the slag hole in the base of the furnace. In the furnace near the boiler the pressure is equal to atmospheric. If the gas passes the pressure is slightly less than atmospheric, an amount depending upon the resistance of friction to a flow of the gases into the uptake.

The lower row of water tubes was shielded by tiles for the purpose of giving sufficient heat-reflecting surface to maintain the desired furnace temperature for the working capacity of the boiler. The best results were obtained when approximately the lower back half of the water tubes was shielded as illustrated in fig. 1. This shielding prevents all tendency to lift and deposit unconsumed fuel in the passes, which, therefore, do not require more cleaning than the passes in the adjoining mechanical stoker-fed boilers. No trouble whatever is experienced from coke or cinder-clogged water tubes; this is largely due to the hopper-shaped furnace, wherein all the downwardly jetted fuel and air from the three tuyeres is thoroughly blended and ignited in the confined space between the inclined and incandescent walls at the bottom of the furnace. Thereafter the resulting gases are permitted to freely expand as they slowly rise upward into the enlarged space under the boiler, in a manner which gives the flames a slow rolling movement from the bottom rearward, upwards, then forward to meet the front end of the boiler, through the full length of a 30-ft. path, before coming in contact with heat absorbing surfaces.

NEW COMPANIES REGISTERED.

British Electron Co., Ltd. (146,067).—Private company. This company was registered on February 19th, with a capital of £3,000 in £1 shares, to carry on the business of importers and exporters of and dealers in metals, metal scrap and ores, chemical manufacturers, metallurgists, detinners, tinplate makers, &c. The subscribers (each with one share) are: H. D. Ashworth, Old Dalby, Ellesmere Road, Eccles, metal refiner; A. Keating, 31, Stockport Road, Ardwick, Manchester, metal refiner; C. R. Adams, 127, Queen's Road, Cheetham, Manchester, metal refiner. The first directors are H. D. Ashworth, A. Keating, and C. R. Adams. Solicitors: Vaudrey & Co., 30, St. Anne's Street, Manchester.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—A memorandum of satisfaction in full on January 11th, 1917, of debentures dated August 13th, 1914, securing £500 has been filed.

Electrical Installations, Ltd.—A memorandum of satisfaction to the extent of £100, on January 26th, 1917, of debentures dated December 5th, 1906, securing £2,000, has been filed.

International Electric Co., Ltd.—Mortgage on freehold property at Tottenham, dated February 8th, 1917, to secure all moneys due or to become due from company to London & South-Western Bank.

Torpoint Electric Supply Co., Ltd.—Second debenture, charged on the general assets, dated February 5th, 1917, to secure £1,089. Also issue on same date of £1,280 debentures, part of a series of which particulars have already been filed.

Llanrwst Electricity Supply Co., Ltd.—A memorandum of satisfaction in full on September 5th, 1916, of first, second, and third mortgage debentures dated 1905, securing £900, £600, and £400 respectively.

CITY NOTES.

Notting Hill Electric Lighting Co., Ltd.

Capital expenditure during 1916 was £995, and the total now exceeds the receipts by £45,320. The lamps connected increased from 238,981 to 241,859, and the profit (less income-tax) fell from £22,617 to £18,782. There are 4,400 consumers, all excepting 20 being supplied at 200 volts. Revenue from sale of current increased by £767 to £43,185. The reduction in profit is due to increased cost of fuel and labour, higher assessment for rates, and an addition of £1,871 to income-tax. Kensington Council approved of the company's proposal to increase charges to consumers by ¼d. per unit to compensate for these burdens, but the increase was only brought into force during the last three months of the year. From the available profit of £23,730 there are taken £3,000 for depreciation, renewal and reserve, £2,016 for debenture interest, Kensington and Notting Hill debenture stock charges £3,695, £4,525 for income-tax, £250 for the staff under the co-partnership scheme, and £10,243 remains. After paying the 6 per cent. preference dividend and 3s. per share, less tax, on the ordinary shares, £403 remains to be carried forward. Annual meeting: March 6th.

Yorkshire Electric Power Co.

At the annual meeting, Mr. A. G. Lupton said that the underlying principle on which the company's business was founded was the economy of fuel which could be secured by the production of electricity on a large scale. The demands upon the company were increasing rapidly in every part of its area. The development of the company in the past had resulted in many undertakings taking a bulk supply instead of building separate generating stations for themselves, and it was gratifying to find that there was a general awakening to the principles on which the power companies were established by Parliament. Last year the Bradford Corporation and the company entered into a reciprocal agreement to supply electricity.

Mr. A. H. Meysey-Thompson, who seconded, said that at last the company had arrived at the turning of a long lane, and they could now feel that they had done their share in clearing the West Riding of the pall of smoke which had so long hung overhead. He hoped that the reciprocal agreement with the Bradford Corporation was an indication of a happier spirit in the relationship between the company and the municipalities in its area.

City and South London Railway Co.

In his speech at the annual meeting, Lord Stuart of Wortley said (according to the *Times* report) that the effect of present conditions on their expenses was very serious. Fortunately, their electrical energy was now supplied from the power station at Lots Road, Chelsea, but the cost of current was necessarily based upon the price of coal, which had more than doubled since the beginning of the war, and was still rising. There had also been a deterioration in its average quality. The increased cost of living had led to demands from their men for additional bonuses. In the case of controlled railways this additional charge was borne by the Government, but in their case it must be found entirely from their own resources. They would have been unable to pay this bonus were it not for the operation of the common fund agreement. In obtaining supplies they were having considerable difficulty. The labour available was limited in amount, and necessarily less skilful than their old trained staff. While nothing had been neglected which was essential to the safe running of the trains, the standard of maintenance—as must be the case with all railways during the war—was not all they would desire under more normal conditions, and this in spite of the fact that expenditure under this heading was above the normal. A year ago he expressed regret at the necessary postponement of the projects for improving and modernising the line and rolling stock, and making what they believed would be a most valuable connection with the London Electric Railway at Camden Town to permit of through running to Hampstead and Highgate. These projects could not proceed until the return to normal conditions.

London Electric Railway Co.

Lord Farrar, at the annual meeting on February 23rd, said (according to the *Financial Times* report) that the extension nection with the L. & N.-W. Railway of the train service to Watford in conhad been delayed on account of the difficulty of obtaining the necessary joint rolling stock, but arrangements had now been made for this company temporarily to supply rolling stock on reasonable terms, and it was anticipated that the through service could be initiated about the beginning of April. The result shown by the Queen's Park extension and the through running to Willesden had, even in these abnormal times, been excellent, and the directors anticipated further improvement from the extension to Watford, although the 50 per cent. increase of fares on the main line railways ordered by the Government would undoubtedly retard the development of the traffic. Suggestions had been made from time to time that the company's fares should be increased, but the directors felt that, as this was a great public utility company, they must consider a matter of this kind from the point of view of public interest, as well as that of revenue-earning power; and, moreover, their past experience had shown that in their area the best way to secure the largest net revenue was to obtain a large volume of traffic by low rates, coupled with quick and frequent service, rather than fewer passengers at high rates. New factors, however, had entered into the problem, owing to war conditions, one of which was the falling purchasing power of money, and if the price of all the commodities the company had to buy continued to rise they felt that a readjustment of fares would be justifiable.

Metropolitan District Railway Co.

Lord George Hamilton, at the annual meeting, said that the working expenses during the year 1916 had heavily increased. The difficulty of securing labour and material for really adequate maintenance of the property had been recognised by the Government, and a special allowance was made to controlled railways to cover this deferred maintenance; but it was doubtful whether the amount, so far as this company was concerned, was sufficient, and increases of reserves against this liability were essential. It had, therefore, been recommended that a total sum of £45,000 be added to the reserves for renewals and contingencies, as against £35,000 last year. While they were under Government control any raising of their fares was, without the consent of the authorities, out of their power, even if it seemed desirable from the revenue point of view. They had always been believers in the lowest reasonable rate of fare, not only because, as a public transport company, they must always carefully consider their relations to the public, but also because they realised that in the long run they made a higher net earning for the shareholders by carrying many passengers at a low fare rather than fewer passengers at a high rate. Low fares and good service stimulated traffic, and that had hitherto been their aim. While they remained believers in the lowest "reasonable" fares, it must be remembered that the decrease in the purchasing power of money in the last two years had practically resulted in a drastic reduction of their fares. The present position, however, could not continue indefinitely, and some readjustment of fares might be necessary. This they would look upon as a reinstatement of fares rather than an increase.

Underground Electric Railways Co. of London, Ltd.

For 1916 the net income from investments, &c., after deducting general expenses, and including balance from last account, was £664,666. After paying the interest on the 4½ per cent. bonds, also the payment under the guarantee on Central London Railway Assented stocks, and the interest on the 6 per cent. first. cumulative income debenture stock, there is a surplus of £436,812. The interest at the rate of 5 per cent. per annum, plus income-tax, on the 6 per cent. income bonds due 1948 absorbs £406,178, leaving £30,634. The income from investments, &c., was £653,361, a decrease of £27,380, or 4.02 per cent. for the year. The income-tax on the interest on the 4½ per cent. bonds due 1933, and on the 6 per cent. income bonds due 1948, together with loss on foreign exchange in respect of coupons encashed abroad, was £134,015, an increase of £56,805, or 73.57 per cent. The aggregate gross revenue of the five companies parties to the Common Fund was £6,038,529; the aggregate retained by them for revenue liabilities, including reserves, was £5,531,562, leaving £506,968, an increase of 12.32 per cent. as compared with 1915. Sir Albert Stanley resigned the managing directorship when he became President of the Board of Trade, and Mr. W. C. Burton takes his place.

Under the provisions of the London Electric Railway Act, 1912, authority was given for the through running of trains from the Bakerloo Section of the railway to Watford on the electrified portion of the London & North-Western Railway. The North-Western Co. had arranged to provide the joint rolling stock required for the services, but its manufacture has been delayed owing to the war. In order to give the public the benefit of this new service without further delay, arrangements have been made between the two railway companies whereby the London Electric Co. will, for the present, provide the necessary trains and work the train service. It is anticipated that this through running will commence early in April.

In order to provide for a larger increase of output from the Associated Equipment Co.'s factory at Walthamstow, extensions of the premises have recently been carried out in co-operation with the Ministry of Munitions.

Para Electric Railways and Lighting Co., Ltd.

At the annual meeting, Mr. Follett Holt said that the net revenue in milreis during the year was the largest yet obtained by the company. This was due to an increase of more than 11 per cent. in the combined gross earnings of the tramways and lighting departments, and to the fact that operating expenses were only 7 per cent. higher than during 1915. The cars carried a total of over 20,000,000 passengers, or 13 per cent. more, whilst the fact that the sale of electricity for lighting and power purposes had increased by 10 per cent. showed that they had reaped some benefit from the greater commercial activity and prosperity of the city of Para. During the year a small investment had been made in the debentures of the Para Gas Co. The progress of the gas business had been slow, but not unsatisfactory, although the full benefit of the combined supply of gas and electricity would only mature after the gasworks had been thoroughly overhauled, which would require some little time. In connection with important public works executed by the Municipality to improve the thoroughfares between the city and the port, certain sections of the tramway system had been relaid and modified, and this had resulted in a better public service and greater facilities. Regarding the present situation of the rubber trade, so intimately connected with the welfare of Para, comparing the crop season ended at June 30th, 1916, with its predecessor, rubber exports from the Amazon district increased from 33,500 tons to 36,725 tons. The total production for the calendar year 1916 was 37,250 tons, as against 37,000 tons during 1915. This figure had been practically constant for the last three years. It was anticipated that the supply for the current year might be somewhat in excess of this average, owing to an abnormally low river, which had enabled rubber collection to be continued somewhat longer than usual. Prices in the London market for fine hard Para had fluctuated during the year between 4s. 1d. and 2s. 7d. per lb., with an average of 3s. 1½d., the value at present being about 3s. 4½d. per lb. Business generally at Para was distinctly brisk, and the country people were prosperous.

City of London Electric Lighting Co., Ltd.—Subject to audit, the directors have decided to provide in full for allowances to employés on service and war bonuses to staff and employés, to place £40,000 to reserve, and to pay 12s. per share (6 per cent. per annum) on the preference shares, and 16s. per share (8 per cent. per annum) on the ordinary shares. On account of these dividends, 6s. per preference share and 6s per ordinary share was paid in September, 1916. After payment of the dividends, less income-tax, and providing for other appropriations, about £17,000 remains to carry forward.

Liverpool Overhead Railway Co.—For 1916 the gross revenue receipts were £107,850, and the working expenses, including reserve, were £77,794. The total passengers carried were 16,674,643, as against 15,082,502 in 1915. The concern continues to operate under the agreement with the Government. After deducting debenture interest, adding the balance brought forward, and paying 5 per cent. on both classes of preference shares, a final distribution at the rate of 4 per cent. per annum on the ordinary shares is to be made, making 3¼ per cent. for the year, leaving £6,801 to be carried forward.

Arizona Copper Co.—This company is paying a dividend of 80 per cent., free of income-tax (equivalent to 100 per cent.), for 1916.

Castner-Kellner Alkali Co., Ltd.—Dividend for 1916, 22 per cent.; £50,000 to depreciation; £39,404 carried forward.

Pennsylvania Water & Power Co.—Dividend, 1¼ per cent. for the quarter to March 31st.

Fife Tramway, Light & Power Co.—Presiding at the annual meeting, Mr. W. Low said that the tramways showed some improvement. Pending receipt of the Treasury consent, the company could not make any arrangements for dealing with the construction of the Rosyth lines. Power and lighting progress had been quite satisfactory, for, although net revenue had been affected by increasing costs, a larger revenue had been obtained. The increased revenue was entirely due to the capital expenditure of past years producing additional business. The total revenue received from the power and lighting undertakings as dividends, fees, &c., amounted to £14,671, against £13,567 for the previous year. The real improvement in the combined undertakings was better than shown by the figures, as they had been able to leave a sum of upwards of £2,000 out of profits in the coffers of the power and tramways companies available for contingencies, so that the improvement over the previous year in the power and lighting properties was upwards of £4,400.

Traction & Power Securities Co., Ltd.—Net revenue for 1916, after deducting expenses, £26,211, plus £8,578 brought forward. The directors recommend a dividend of 6s. per share, free of tax, absorbing £25,623, and leaving £9,167 to be carried forward. Investments in the Mersey Railway Co. and the Clyde Valley Electrical Power Co. remain unchanged. The position of the Clyde Valley Power Co. continues to improve. According to a valuation furnished by Glasgow brokers, the holdings in both preference and ordinary shares are worth their book cost. In October last this company declared a first dividend upon its ordinary shares. In view of the Government measures with the object of maintaining foreign exchanges, almost the whole of the company's American investments have been realised.—*Financial Times.*

Compania de Electricidad de la Provincia de Buenos Aires.—The gross receipts for the year ended July 31st last from the supply of light and power were £189,883, against £177,888 for the preceding year, an increase of 6.73 per cent. The total receipts from all sources, £192,239, show an increase of 7.50 per cent. The increase on the total operating expense is only 10.07 per cent. The resulting net profit from operation is £62,728, against £61,160 for the preceding year. The directors have placed the whole of the available balance of £11,639 to the reserve for depreciation and doubtful debts. The results do not permit the payment of a preference dividend.—*Times.*

Oxford Electric Co., Ltd.—The profit for 1916 was £11,682, plus £968 brought forward. Debenture interest absorbs £2,000, there is written off on account of hire-purchase installations £639, 5 per cent. is paid on the preference capital, and 5 per cent., less income-tax, on the ordinary, £649 being placed to the credit of reserve and renewals, leaving £645 to be carried forward. Reserve and renewal of plant account has been charged with the cost of plant replaced. War-time conditions have further decreased the demand for light, and the heavy cost of fuel, &c., has also adversely affected the revenue. Several extensions of mains have been carried out.

British L. M. Ericsson Manufacturing Co., Ltd.—The profit for 1916 constitutes a record, and the prospects for 1917 are excellent. The net profit, after charging £13,963 for depreciation, £6,580 for income-tax, and £2,500 for debenture interest, is £47,146, plus £6,616 brought forward. The preference dividend absorbs £5,999; 8 per cent. on the ordinary shares (free of income-tax) requires £8,001; there is placed to reserve £9,000, and to reserve for extra depreciation £5,000, leaving £25,761 to carry forward, subject to Munitions Levy and Excess Profit Duty.

Telegraph Construction & Maintenance Co., Ltd.—Net profit for 1916, £111,915, after charging interest on the debentures; £110,474 brought forward, making £222,389. Interim dividend of 5 per cent. already paid. A further dividend of 10 per cent., together with a bonus of 12s. per share, free of tax, now to be paid, and there is to be put to supplement the reserve fund £20,000, leaving £112,749 to be carried forward.

County of London Electric Supply Co., Ltd.—After paying the preference dividend (6 per cent.), a final dividend at the rate of 9 per cent. per annum, less income-tax, is recommended on the ordinary shares, making 7 per cent. for the year. £45,000 is put to reserve for depreciation, and £18,000 carried forward.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—According to the *Times*, the directors are preparing an amended scheme, after considering the points discussed at the recent meeting.

Electro Bleach and By-Products, Ltd.—Further interim dividends on account of the year 1916 of 3½ per cent., less tax, on the preference shares, and of 7 per cent., less tax, on the ordinary shares.

W. T. Henley's Telegraph Works Co., Ltd.—Warrants for the dividend on the preference shares were posted on February 28th.

Mirrlees Watson Co., Ltd.—A financial contemporary says that the dividend for 1916 is 10 per cent., less tax, as against 5 per cent. for 1915.

Brazilian Traction, Light & Power Co., Ltd.—Quarterly dividend 1½ per cent. on the cumulative preference shares.

Blackpool & Fleetwood Tramroad Co.—At the annual meeting, Mr. John Greenwood said that during the year the company had carried nearly 300,000 more passengers. With regard to the cliff encroachments adjoining the tramroad, it could only be said that the negotiations had not yet reached a stage which enable the board to make any report to the shareholders.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Dividend, 3½ per cent. on the ordinary shares for the last half-year, making with the interim dividend 6 per cent. for the year.

Stock Exchange Notice.—Application has been made to the Committee to appoint a Special Settling Day in—

Marconi International Marine Communication Co., Ltd.—Further issue of 43,916 shares of £1 each, fully paid, Nos. 306,085 to 350,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Subject to audit, the directors recommend a final dividend of 4½ per cent. on the ordinary shares, making, with the interim dividend of 2½ per cent., 7 per cent. for the year.

Halifax & Bermudas Cable Co., Ltd.—Interim dividend, 6 per cent. per annum, free of income-tax, on ordinary shares for the past half-year.

Direct West India Cable Co., Ltd.—Interim dividend, 6 per cent. per annum, free of income-tax, on ordinary shares for the past half-year.

City of Carlisle Electric Tramways Co., Ltd.—After paying debenture interest and putting £2,000 to redemption of second debentures, £775 remains to carry forward.

STOCKS AND SHARES.

Tuesday Evening.

The very success of the War Loan has tended to exercise a slightly depressing effect upon markets of the investment order. It is difficult to find words in which adequately to describe the result of the Loan, but the figures themselves are sufficient to do away with the necessity for any exaggeration or picturesqueness. There was, let it be confessed now, just a shade of disappointment in the City when the earlier result of 800 millions was announced; but for the total to have passed the £1,000,000,000 mark is regarded as a triumph, while the news of the fine advance of the British on the Ancre forms a fitting complement to the financial operations at home.

Nevertheless, as already pointed out, other markets are dull, and must perforce be so, because of the withdrawal of so much capital from the ordinary investment channels. The effect of the War Loan is likely to be felt for some weeks, and, meanwhile, the purely investment stocks lie under a cloud of quietude, for the simple reason that people have not got the money wherewith to buy them—to buy them, that is to say, in sufficient amounts to compensate the ordinary stream of selling which is common to all times.

Most of the London electric lighting companies have now declared their dividends, and the results are certainly good. No change has taken place in the declarations of the City of London, County, St. James', South Metropolitan, or Westminster Companies. The Kensington & Knightsbridge, paying 6 per cent., shows a reduction of 1 per cent. on the year; and the dividend on Notting Hill ordinary shares is reduced from 5s. to 3s. Considering, however, that the Notting Hill shares are held privately, that they are of the nominal value of 1s. each, and that they stand at something like £2 in the market, it cannot be said that the Notting Hill is a factor in the situation.

The disappointment this half-year has been with the results of the London Electric Supply Corporation, where the reduction of the preference dividend came as a sharp shock. Several other announcements are due this week, but the market, in the light of those made so far, which we have quoted, professes itself to be fully satisfied with the announcements already published. The Daylight Saving Bill will hold less terror for the illumination companies than it did a year ago, and is not at all likely to lead to any particular selling. On the week, County of London ordinary are better at 10⅛, City Preferences are ¼ up, and so are Westminsters. London Electrics naturally continue depressed, and in other shares no recordable changes have occurred.

Brazilian Tractions have fallen back 2 to 46½, this being due to the flatness which overtook most things connected with Brazil upon Mr. Lloyd George's statement that imports of coffee from foreign countries were to be prohibited. The bonds of the various tramway companies are not much affected, the limited character of the market saving them from any particular fall. But most other stocks and shares connected with the country are easier.

The Argentine group is heavy; and so far as Mexicans are concerned, nothing fresh has transpired in the way of news to give any stimulus to the various industrial issues. Mexican things generally, in fact, are flat; and the question remains unanswered as to why America is unable to control the handful of turbulent folk who live across the Mexican frontier.

It is of academic interest to holders of electric lighting shares to notice that the Welsbach Incandescent Co. has formulated a scheme whereby a re-arrangement of capital has been sanctioned by the Treasury; and the company is now offering to its shareholders further shares of £1 each at par, with a commission of 9s. per share to subscribers—which, in other words, means that the £1 shares will produce 11s. for the benefit of the company.

The speculation in Marconis has come to something of an abrupt stop, and, in consequence, the parent shares have fallen back 3/16, which brought about a slight reaction in the quotations for the subsidiaries also. The telegraph market as a whole is quiet. Great Northerns rose 10s., while Eastern ordinary lost a similar amount. Oriental Telephones are good, with a further rise of 1/16 at 2⅛.

Of the manufacturing shares, Henleys are a little lower at 15, but the preference at 4 ex dividend have recovered the amount of the deduction. India-Rubbers fell ¼. British Insulated ordinary had a sharp rise of 12s. 6d. to 12¼. Recent buyers have found a growing scarcity of shares; and as soon as the very small handful on offer in the market had been disposed of, the effect of the demand became apparent. Other industrials are quiet, without commanding much business, but most of those connected with the electrical industry maintain their prices. One of the present features is a strong market in shares of rubber companies which confine themselves to the production of rubber. Those engaged in the coffee business, in addition to rubber, are being put down because of the restriction of the imports of foreign coffee, but the remainder of the list is exceedingly firm, enjoying also a good deal of business.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Feb. 27, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary ..	5	5	3⅝	—	7 8 2
do. do. do. 4½ Pref..	4½	4½	5 7/16 xd	—	7 1 2
Chelsea	5	4	3	—	6 13 4
City of London	9	8	11	—	7 5 5
do. do. 6 per cent. Pref.	6	6	9⅛	+ ⅛	6 1 6
County of London	7	7	10½	—	6 18 3
do. 6 per cent. Pref.	6	6	9⅛	+ ⅛	6 6 4
Kensington Ordinary	9	7	5⅜	—	5 11 7
London Electric	4	3	1	—	Nil
do. do. 6 per cent. Pref.	6	6	3⅝ xd	+1/-	5 6 8
Metropolitan	3½	3	2¼	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3⅝	—	7 4 0
St. James' and Pall Mall ..	10	8	6	—	6 13 4
South London	5	5	2⅝	—	6 19 0
South Metropolitan Pref. ..	7	7	1⅝	—	8 7 3
Westminster Ordinary	9	7	5⅜	+ ⅛	6 1 9
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	94	—	6 7 8
do. Def.	80/-	38/6	22	—	6 16 4
Chile Telephone	8	8	6 5/8	—	6 15 3
Cuba Sub. Ord.	5	5	8¼	—	6 8 6
Eastern Extension	7	8	13⅜	—	*6 16 4
Eastern Tel. Ord.	7	8	136½	— ½	*5 17 4
Globe Tel. and T. Ord.	6	7	11½	—	*5 19 2
do. Pref. ..	6	6	9⅜	—	6 3 1
Great Northern Tel.	22	22	84½	+ ½	6 7 5
Indo-European	18	18	46½	—	6 19 9
Marconi	10	10	2 3/16	— 3/16	8 11 2
New York Tel. 4½	4½	4½	101	—	4 9 0
Oriental Telephone Ord. ..	10	10	2⅛	+ 1/16	4 14 1
United R. Plate Tel.	8	8	6⅜	—	*6 5 6
West India and Pan.	1	6d.	1	—	2 4 0
Western Telegraph	7	8	13⅜	—	*5 16 4
Home Rails.					
Central London, Ord. Assented	4	4	60½ xd	—	6 8 0
Metropolitan	1¾	1	26	—1	4 7 0
do. District	Nil	Nil	15	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	— ⅛	Nil
do. do. "A" ..	Nil	Nil	5/6	—	Nil
do. do. Income	6	6	85	—	*5 17 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅛	—	6 1 6
Anglo-Arg. Trams, First Pref.	5½	5½	2⅞	— 1/16	9 11 4
do. 2nd Pref. ..	5½	5½	2⅜	— ⅛	—
do. 5 Deb. ..	5	5	64½	—	7 15 0
Brazil Tractions	4	4	46½	—2	8 13 0
Bombay Electric Pref.	6	6	10	—	6 0 0
British Columbia Elec. Rly. Pfce.	5	5	61	—	8 4 0
do. do. Preferred	—	Nil	43	—	Nil
do. do. Deferred	—	Nil	37½	—	Nil
do. do. Deb.	4½	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	25	—	Nil
do. 6 per cent. Bonds	—	Nil	22½	—	Nil
Mexican Light Common ..	Nil	Nil	7½	—	Nil
do. Pref.	Nil	Nil	14½	—	Nil
do. 1st Bonds ..	Nil	Nil	27½	—	—
Manufacturing Companies.					
Babcock & Wilcox	14	15	23	—	5 9 1
British Aluminium Ord. ..	5	7	28/-	—	5 7 2
British Insulated Ord. ..	15	17½	12¼	+ ⅝	7 0 0
British Westinghouse Pref. ..	7½	7½	2 3/32	—	6 11 8
Callenders	15	20	19½	—	8 4 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	20	22	8⅜	—	6 10 8
Edison & Swan, £3 paid ..	Nil	—	⅛	—	Nil
do. do. fully paid ..	Nil	—	1⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	61½	—	6 10 1
Electric Construction	6	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	9½	—	6 9 9
do. Ord.	10	10	13⅜	—	7 5 6
Henley	20	25	15	— ½	8 6 8
do. 4½ Pref.	4½	4½	4 xd	+ ¼	6 12 6
India-Rubber	10	10	11½	— ¼	*8 13 10
Telegraph Con.	20	20	87	—	*6 15 2

* Dividends paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 28th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic .. .. per lb.	1/6	..
a Ammoniac Sal .. .. .. per ton	£75	..
a Ammonia, Muriate (large crystal) „	£54	..
a Bisulphide of Carbon .. .. „	£28	..
a Borax .. .. „	£34	..
a Copper Sulphate .. .. .. „	£68	£3 dec.
a Potash, Chlorate .. .. .. per lb.	2/6	..
a „ Perchlorate .. .. „	2/-	..
a Shellac .. .. per cwt.	170/-	14/- inc.
a Sulphate of Magnesia .. .. per ton	£16	..
a Sulphur, Sublimed Flowers .. „	£30	£5 inc.
a „ Lump .. .. .. „	£23	£4 inc.
a Soda, Chlorate .. .. .. per lb.	1/-	..
a „ Crystals .. .. .. per ton	130/-	..
a Sodium Bichromate, casks .. per lb.	..	..
METALS, &c.		
c Brass (rolled metal 2' to 12' basis) per lb.	..	..
c „ Tubes (solid drawn) .. „	..	..
c „ Wire, basis .. .. .. „	..	..
c Copper Tubes (solid drawn) .. „	1/8½ to 1/9½	½d. to ½d. in.
g „ Bars (best selected) .. per ton	£174	£4 inc.
g „ Sheet .. .. .. „	£174	£4 inc.
g „ Rod .. .. „	£174	£4 inc.
d „ (Electrolytic) Bars .. „	£161	£4 inc.
d „ „ Sheets .. „	£176	£4 inc.
d „ „ Wire Rods „	£159	£4 inc.
d „ „ H.C. Wire per lb.	1/7	½d. inc.
f Ebonite Rod .. .. „	3/-	..
f „ Sheet .. .. „	2/6	..
n German Silver Wire .. .. „	2/8	..
h Gutta-percha, fine .. .. .. „	6/10	..
h India-rubber, Para fine .. .. „	3/3½	1d. dec.
i Iron Pig (Cleveland warrants) .. per ton	Nom.	..
l „ Wire, galv. No. 8, P.O. qual. „	£88	..
g Lead, English Pig .. .. .. „	..	..
g Mercury .. .. per bot.	Nom.	..
e Mica (in original cases) small .. per lb.	6d. to 8/-	..
e „ „ „ medium „	3/6 to 6/-	..
e „ „ „ large .. „	7/6 to 14/- & up.	..
d Silicium Bronze Wire .. .. per lb.	1/10	..
r Steel, Magnet, in bars .. .. per ton	..	..
g Tin, Block (English) .. .. „	..	..
n „ Wire, Nos. 1 to 16 .. .. per lb.	8/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Scarcity of Materials in Germany.—Swiss members of the Société des Installateurs Suisses who attended the yearly meeting of the German Union of similar societies at Frankfort-on-Main, in July last, have given in the Swiss *Elektro-Industrie* an account of their impressions of the present condition of the German electrical industry. Their opinion is that, contrary to the usual view, Germany is not short of copper, as the requisition of German domestic copper utensils had produced some 300,000 to 400,000 tons of copper, sufficient to supply needs for three years of war. Furthermore, German and Serbian mines were producing, and other supplies were furnished by all the neighbouring neutral countries. Moreover, Germany required, when exporting machinery to neutral countries having copper or copper alloy constituents, an excess of 30 per cent. of copper or copper alloys in any return imports from neutral countries. The substitution of zinc or iron for copper in certain cases had also effected considerable saving of that metal. As regards aluminium, the Swiss Neuhausen works were under contract to supply the whole of their output to Germany; further, an alloy of aluminium and other metal was made use of for the building of aircraft. An antifriction alloy had also been found to replace in most cases the usual antifriction compound. Hence the Swiss delegates think Germany is able to do well without copper imports from other countries. A different aspect to this favourable estimate of German conditions is furnished by a fraud, pointed out by *La Revue Electrique*, which German manufacturers are resorting to, which consists in coating substitute metals with copper. The Geneva Chamber of Commerce recently called attention to this subject, and stated that there existed in Switzerland a whole stock of machines thus fraudulently manipulated, which must await the end of the war in order to be put into a condition to be of service. With regard to rubber the Swiss delegates admit that the scarcity is practically absolute.

Although some imaginary admissions are made as to German conditions by this Swiss report, it is to be observed that the journal which publishes them does not scruple to avow its pro-German proclivities, while the Swiss delegates themselves, as being guests of their German hosts, could not but speak in a way most agreeable to them.—*La Revue Electrique*.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1917.

The returns of electrical exports and imports for the opening month of the year show a considerable appreciation in value in both sections as compared with the closing months of 1916. The electrical exports for the month were valued at £556,984, as compared with £405,921 in December last, the total being a very satisfactory one judged by last year.

This total was due mainly to the export of, roughly, £100,000 worth of telephonic material to France, aided by an all-round improvement in business. The cable exports increased from £70,000 in December to £96,000 in value last month, while machinery exports were similarly £10,000 to the good, and advances took place in other directions, the only appreciable falling off being in telegraphic exports.

The imports of electrical material reached £309,381 in value, as compared with £246,252 in December, the increase being traceable to the higher values of machinery entering this country, as also to increased battery imports, which together more than compensated for a considerable falling-off in telegraphic, telephonic, lamp, and cable imports.

The re-exports, at £33,557, far exceeded the December value, and indeed reach a comparatively high level.

During the month France, for obvious reasons, was our best customer, and Russia (principally) and the Scandinavian countries absorbed a high value of material from this country, while India, our Australasian Colonies, and Argentina were also prominent purchasers.

The bulk of the increased imports into this country were of American origin, although it may be worth noting that Japan's share of the business reached nearly £20,000 in value, and was, therefore, only a little inferior to that of Holland, which has for some time occupied the second place.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	7,163	14,484	479	531	114	2,505	27,489	3,849	432	1,565	6,404	9,369	74,384
Netherlands, Java and Dutch Indies ...	134	3,081	850	...	49	134	1,670	184	43	39	1,243	713	8,140
Belgian Congo...	38	...	...	77	...	...	...	...	...	...	48	23	186
France	2,836	8,433	1,242	593	11	12	22,945	12,239	552	...	103,398	948	153,209
Portugal	...	2,015	...	...	...	115	537	111	28	...	52	210	3,068
Spain, Canary Isles and Spanish N. Africa...	1,216	405	151	...	...	1,550	7,090	982	33	...	36	1,273	12,736
Switzerland, Italy and Austria-Hungary ...	645	925	...	...	...	252	1,961	...	31	...	898	5,269	9,981
Greece, Roumania, Turkey and Bulgaria ...	...	...	...	...	...	...	...	...	...	130	...	...	130
Channel Isles, Gibraltar, Malta and Cyprus...	107	...	10	46	...	163	16	70	150	...	...	8,360	8,922
U.S.A., Philippines and Cuba	1,534	...	202	...	...	114	4,527	...	...	38	315	296	7,026
Canada and Newfoundland	294	31	543	22	...	77	213	33	...	229	...	9,953	11,395
British West Indies and British Guiana ...	10	14	52	...	...	...	459	202	25	26	...	17	805
Mexico and Central America	...	157	...	...	...	...	...	...	...	...	253	38	448
Peru and Uruguay	57	9,338	150	159	...	12	115	...	136	79	4	81	10,131
Chile	164	429	314	148	...	373	2,399	110	117	16	66	82	4,218
Brazil	866	580	170	488	...	474	4,178	108	226	99	140	2,260	9,589
Argentina	1,757	3,783	4,422	1,068	...	798	3,456	870	3,711	150	3,153	4,779	27,947
Colombia, Venezuela, Ecuador and Bolivia...	186	157	3	24	...	...	502	...	...	...	267	76	1,215
Egypt, Tunis and Morocco	76	130	28	404	...	176	915	170	1,061	...	105	232	3,297
British West Africa	23	216	86	36	...	...	349	...	...	...	163	245	1,118
Rhodesia, O.R.C. and Transvaal	1,259	940	1,070	813	...	90	6,057	3,205	224	76	...	73	13,807
Cape of Good Hope	402	1,795	703	227	...	...	2,217	297	196	...	195	28	6,060
Natal	375	2,158	137	161	...	30	3,598	47	377	3	1,858	106	8,850
Zanzibar, Brit. E. Africa, Mauritius & Aden	465	424	57	421	...	...	181	261	27	50	63	201	2,150
Azores, Madeira and Portuguese Africa ...	3	159	36	...	...	47	323	47	...	...	...	400	1,015
French African Colonies and Madagascar...	...	...	...	...	...	...	232	...	...	...	...	10	242
Persia	...	...	...	...	...	...	...	...	...	...	...	...	...
China and Siam	1,301	2,233	1,473	1,061	2,117	331	5,957	180	...	...	123	1,050	15,826
Japan and Korea	3,905	...	34	13	...	411	1,342	256	419	...	...	221	6,601
India	2,178	5,570	4,260	2,510	30	2,029	25,433	2,766	4,917	111	2,001	219	52,024
Ceylon	86	231	93	64	...	65	...	...	50	...	47	...	636
Straits Settlements, Fed. Malay States and Sarawak	176	659	962	286	...	91	1,802	44	134	94	26	367	4,641
Hong Kong	957	289	633	347	...	722	2,033	304	153	3	48	...	5,489
West Australia	...	429	1,772	55	...	851	588	...	...	...	77	...	3,772
South Australia	54	57	180	128	...	...	250	420	460	37	371	132	2,089
Victoria	1,235	15,401	2,372	468	...	729	13,533	670	196	...	699	39	35,342
New South Wales	833	14,899	1,133	510	12	670	4,442	3,243	192	31	236	124	26,325
Queensland	13	...	48	45	...	...	795	...	30	...	...	...	931
Tasmania	3	...	30	35	...	...	775	...	10	...	...	...	853
New Zealand and Fiji Islands	312	6,784	2,288	264	14	352	2,425	567	5,819	...	311	3,250	22,386
Total, £	30,663	96,206	25,983	11,004	2,347	13,173	150,804	31,235	19,749	2,776	122,600	50,444	556,984

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	75	...	...	568	3,743	...	3,940	380	3,632	1,915	12	14,265
Netherlands	131	870	...	16,062	5,064	...	209	10	1,163	...	...	23,509
France	96	...	4	58	80	1,088	1,198	80	7,853	1,327	222	12,006
Switzerland	3,291	...	417	31	40	816	1,083	68	2,658	3,933	...	12,337
Italy	18	1,019	...	...	...	...	1,912	...	...	...	...	2,949
Japan	1,366	...	4,718	12,327	1,347	...	...	...	65	...	72	19,895
United States	6,255	10,172	1,962	4,420	1,717	7,163	15,613	108,251	27,118	8,936	30,419	220,026
Total, £	11,232	12,061	7,101	33,466	11,991	9,067	23,955	108,789	42,489	16,111	30,725	306,987

Additional imports.—Canada, glow lamps, £54; arc lamps, £75; meters, &c., £12; batteries and accumulators, £1,988; telephone and telegraph appliances, £265.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	3,223	22,782	35	2,692	269	754	1,998	...	65	279	1,460	33,557

TOTAL EXPORTS: £556,984 TOTAL RE-EXPORTS: £33,557 TOTAL IMPORTS: £309,381

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin.

SOME POINTS IN CONNECTION WITH ENGINEERING SPECIFICATIONS.

By J. SHEPHERD, M.I.E.E.

(*Paper read before the* YORKSHIRE LOCAL SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS *at Leeds.*)

THE importance of specifications to the purchaser, the contractor, and the engineer, can hardly be overestimated, as they form the basis of contracts, and should include a concise description of the purchaser's requirements so as to enable orders to be placed in a business-like way for the plant required.

Specifications, whether long or short, should contain all salient facts necessary for the contractor to carry out his work, and should include a lucid description of the conditions under which the contract is to be completed.

Specifications for work of some magnitude usually consist of three distinct parts, namely, general conditions, detailed technical requirements, and a bill of quantities.

General Conditions.—The general conditions, which are of the nature of standing orders, are usually of a legal character. They are of great weight and importance, and are usually drafted by solicitors or town clerks. In many cases they have grown to imposing documents, and unfortunately have sometimes formed a weapon which has been used to the detriment of the industry generally, since they have resulted in orders being sent abroad where the foreign contractor, owing to his distance from this country, has escaped the results of several of the conditions.

The British Electrical and Allied Manufacturers' Association have been engaged for the last few years in framing an independent set of conditions. These favour the manufacturer's rather than the purchaser's interests, and up to the present have not received general acceptance. The Institution have drawn up and issued an independent set of conditions, and as the committee entrusted with the work comprised representatives of both manufacturers and engineers, the result has been a set of conditions which are generally equitable to both parties.

Whatever general conditions are adopted, I am strongly of the opinion that all matters in dispute should be referred to independent arbitration, provided that the progress of the work is not prejudiced thereby; that is to say, the two sides should agree as to what points are in dispute, and these can then be the subject of independent arbitration after the work is completed.

Detailed Technical Requirements.—This part of the specification is entirely the engineer's province, and in it he has clearly to define his requirements. Before he can do so he must make up his mind as to what he really does want, and, having done so, he should lay down his requirements in the simplest language, so that, if possible, a child could understand the story.

There should be no necessity in modern specifications for the threadbare phrase: "Notwithstanding any errors or omissions the work omitted shall be included as though specifically mentioned."

Bill of Quantities.—Wherever possible the work should be scheduled, and a complete list of quantities closely estimated and arranged for pricing up should be given. In this bill of quantities should be included any provisional sums for extra work or for any special apparatus which it may be desired to purchase.

Having very briefly outlined the skeleton of a specification, a few examples may now be given of various specifications drafted during the last dozen years for various classes of engineering work required for a large public body who was the purchaser. In considering these specifications the attitude of the purchaser must not be forgotten. That attitude might perhaps be defined thus:—

"The market includes a large number of willing and eager suppliers anxious for our contracts at reasonable prices; the engineer shall therefore draft a clear and concise specification free from all looseness of thought or description or errors of any character. When the tenders are received to such a specification, we can, without misgiving of any kind, accept the lowest tender, no matter from whom it may be, and in order that we may know that the prices tendered are reasonable, the engineer shall, with the tenders, and before they are opened, submit his estimate of the cost of the work."

The specifications described below have all been drafted to suit such a general condition of affairs as far as it is possible to do so, and those members who do not agree with the drafting of the specifications must bear in mind the conditions under which they were drawn up.

One essential difference between a specification for machinery of standard design and a specification for, say, civil engineering or architectural work, should at once be observed. No engineer with whom the author is acquainted is so bold as to issue working drawings of, say, a turbo-generator, high-speed engine, or water-tube boilers which he may desire to purchase. On the other hand, nearly all civil engineering and architectural work is the design, and is carried out to the detailed drawing, of the civil engineer or architect. But even in this branch of the profession the old order is changing with newer methods of construction, such as structural steel work, reinforced concrete, &c., which require certain of the designs to be left to the specialists who handle this type of construction, and there is but little doubt that in the future the change will become more pronounced.

The engineer has the choice of two methods of specifying. These are:—

1. Issuing detailed drawings of his requirements and accepting the responsibility of the design, leaving the contractor to be responsible for the material and workmanship.

2. Defining the conditions and results to be obtained, leaving the contractor to meet the requirements with his standard products if and when they are suitable.

If the engineer specifies the conditions and the results required, and leaves the manufacturer to offer his standard designs, the results will generally be satisfactory if the engineer is allowed to select as his contractors a firm of known excellence and of ripe experience. Unfortunately, however, the tender of such a firm is seldom the lowest, and the premises were that the lowest tender should be accepted.

Again, the manufacturer has not always extensive experience of the running of his own plant, or the opportunity of rectifying the weak features of a design, which use alone will discover. Also, it is not uncommon for some manufacturers to perceive with difficulty any defects in their products. The defects, when investigated, not infrequently are found to be due to an inexperienced draughtsman or to drawing-office instructions not reaching the shops in a clear form, or poor workmanship.

The following are the salient features of a number of recent specifications:—

COAL.

In a large generating station having a good load factor, efficient turbine units, good superheat and condensing conditions, and coal at normal prices, the generating costs per unit may be taken to be as follows:—

Salaries and wages	0.030d.
Coal and ashes	0.160d.
Oil, waste, and stores	0.004d.
Repairs to plant and buildings	0.012d.
Total	0.206d.

Coal and ashes thus represent 78 per cent. of the total, *i.e.*, out of every sovereign spent in the station 15s. 6d. is required for the supply of coal and the removal of ashes, excluding for the moment questions of capital charges. With the present high prices of coal the proportion is now even higher.

With such high costs the desirability of buying coal cheaply is apparent. A buyer with free power to purchase in the open market, and with plenty of storage capacity for the coal when purchased, will probably buy most cheaply by picking up "spot lots" where available, and especially at or near a port, but, of course, such conditions do not apply to present times.

When buying by contract, some form of scientific specification is necessary where locality and circumstances allow a free market, and the specification described below is framed with a view to buying coal in this manner. As over 1,000,000 tons have been purchased in this way, it may be said to have proved itself useful by the only true test, namely, experience.

Roughly, the specification may be said to contain and set out—

Quantity required, viz., 165,000 tons per annum.

Minimum quality to be accepted, viz.:—

Calorific value not less than 11,000 B.TH.U.

Moisture must not exceed 14 per cent. for washed nuts, or 9 per cent. for unwashed nuts.

Small coal must not exceed 30 per cent.

Ash must not exceed 15 per cent.

Delivery by steamer, and the berthing conditions are also set out.

Methods of sampling are given in detail, but in later specifications the final sampling was done by a motor-driven crusher and sampler.

Methods of testing are then specified, namely:—

(*a*) For small coal, through a sieve with a mesh ½ in. square.

(*b*) Calorific value by Mahler bomb calorimeter.

(*c*) Moisture after drying at a temperature of from 104 deg. to 111 deg. C.

(*d*) Ash determined by ignition at a low red heat.

When tendering, the contractors are requested to state both the price and the values offered of the following particulars:—

(A) Calorific value in British thermal units.
(C) Moisture in percentage by weight.
(E) Small coal percentage by weight.
(G) Ash percentage by weight.

These values must not be inferior to the minimum values allowed, as already described.

The specification provided for the adjustment of the price paid for any particular cargo in accordance with the values actually obtained for that cargo, the adjustment being made as set out below.

"Should the quality of the coal in any cargo, as ascertained by samples tested, be found different, as regards calorific value, moisture, small, or ash from the values offered in the schedule, the prices or sums payable as aforesaid shall be varied in the manner following, viz.:—

"(*a*) If the calorific value be greater than the number of British thermal units per lb. offered in the schedule, the

price per ton shall be increased in the same percentage ratio as the increase in the calorific value.

"(*b*) If the calorific value be less than the number of British thermal units per lb. offered in the schedule, the price per ton shall be decreased in the same percentage ratio as the decrease in the calorific value. Provided always that the Council shall have the right to reject the whole cargo if the calorific value be less than 11,000 British thermal units per lb.

"(*c*) If the moisture be less by weight than the figure offered in the schedule, the weight of the coal to be paid for shall be increased beyond the quantity actually weighed out by a percentage equal to the percentage decrease of moisture.

"(*d*) If the moisture exceed by weight the figure offered in the schedule, the weight of the coal to be paid for shall be decreased below the quantity actually weighed out by a percentage equal to the percentage increase of moisture. Provided always that the Council shall have the right to reject the whole cargo if the moisture exceed 14 per cent. by weight for washed nuts or 9 per cent. by weight for unwashed nuts.

"(*e*) If the proportion of small coal in either singles or doubles be less by weight than the figure offered in the schedule when determined in the manner set out in Clause No. 10 of this specification, the weight of the coal to be paid for shall be increased beyond the quantity actually weighed out by a percentage equal to one quarter of the percentage decrease of small coal.

"(*f*) If the proportion of small coal in either singles or doubles exceeds by weight the figures offered in the schedule, when determined in the manner set out in Clause 10 of this specification, the weight of the coal to be paid for shall be decreased below the quantity actually weighed out by a percentage equal to one quarter of the percentage increase of small coal. Provided always that the Council shall have the right to reject the whole cargo, if the proportion of small coal exceeds 30 per cent. by weight.

"(*g*) If the percentage of ash when determined in the manner set out in Clause No. 10 of this specification be less than the figure offered in the schedule, the net rate per ton of coal shall be increased by 1d. for every 1 per cent. reduction in ash.

"(*h*) If the percentage of ash when determined in the manner set out in Clause No. 10 of this Specification be more than the figure offered in the schedule, the net rate per ton of coal shall be reduced by 1d. for every 1 per cent. increase in ash. Provided always that the Council shall have the right to reject the whole cargo if the proportion of ash exceeds 15 per cent."

The adjustment may appear somewhat cumbrous, but in practice is not found to be so, and an actual copy of an invoice worked out in detail is set out below.

Cargo of Scotch Nuts.

Weighed on delivery, 1,447 tons 10 cwt.

	Values determined by analysis.	Values offered in tender.	Difference.
Small	14·70 %	20%	+ 5·3
Moisture	13·45 %	9%	− 4·45
Cal. Val.,	13,070 B.TH.U.	12,500	+ 579 = 4·56%
Ash	8·53 %	10%	+ 1·47%

Basis price for quality tendered, 15s. 10d. per ton.

	T.	cwt.	qr.			
Coal as weighed...	1,447	10	0			
Deduct for 4·45 % moisure	64	8	1			
	1,383	1	3			
Add for small ¼ (5·3) = 1·325 % ...	19	3	2			
	1,402	5	1 at 15s. 10d. =	£	s.	d.
				1,110	2	6
Add for calorific value, 4·56 %				50	12	5
Add for ash, 1·47d. per ton				8	17	4
				£1,169	12	3
Note price at net rate of 15s. 10d., *i.e.*, 1,447 tons 10 cwt. at 15s. 10d. would have been				£1,145	18	9
Bonus on the cargo				£23	13	6

The reasons for the adjustments of prices are fairly obvious. The price varies directly as the calorific value, and inversely as the percentage of moisture. As regards small coal, for each 4 per cent. increase, the rate is diminished 1 per cent.

The ash is indirectly allowed for by diminished calorific value, but a further penalty of 1d. per ton for each 1 per cent. increase over the standard figure is deducted to cover the cost of conveying the ashes away by barges.

As the coal tendered by different contractors may, and usually does, vary in value, the rates per ton offered cannot be directly compared without adjustment to a common basis of "standard coal" which, for the purpose of comparing tenders, was taken at:—

Small 20 per cent.
Calorific value 12,500 B.TH.U.
Moisture 9 per cent.
Ash 10 per cent.

After the comparison had been made and the tenders awarded, all further adjustments for payment were made in a similar manner to the example already given.

The volume of business dealt with by specifications of the character described was 100,000 tons in 1906, increasing year by year to 160,000 tons in 1915. This necessitated the removal from the boiler house of from 10,000 tons to 16,000 tons of ashes per annum.

The coal usually purchased under these specifications was Scotch washed nuts, shipped from various ports on the Firth of Forth, and Yorkshire washed nuts, shipped from Goole. The Yorkshire coal has the higher calorific value, but when burnt under water-tube boilers it was found to be more destructive of the brickwork settings, a factor which the specification does not, of course, allow for.

If the recovery of by-products becomes practicable in a power station, modifications in the specification for coal will no doubt become necessary to suit the nitrogen contents of the fuel.

In passing, it might be remarked that a specification for fuel is somewhat unique, having nothing quite analogous in the ordinary run of civil engineering or architectural practice.

The specifications have enabled purchases to be made in the open market for the past 10 years without giving rise to a single dispute as to the value of the coal determined on delivery, and for which the price was adjusted on the determination.

(*To be concluded.*)

Discussion.

Mr. Selbey said one of the things people ought to be on their guard against was making the specification too elaborate. He had come to take the view that the safest way for a man to buy, who was not acquainted in great detail with what he wanted, was not to attempt the elaborate kind of specification which Mr. Shepherd had dealt with, but to specify for the supply of apparatus necessary to produce a certain result, and if it was made clear that that result was to be got, and the contractor accepted that obligation, the buyer's rights in common law would be just as good as any detailed specification could give him. His experience was that causes of trouble were almost entirely what was known as case law, depending upon previous decisions, and there was a better chance on the concrete issue whether the contractor had really supplied apparatus which would fulfil the purpose desired than when he had supplied the apparatus to a detailed specification.

Mr. Woodhouse said he felt that conditions of contract drawn up by manufacturers favoured manufacturers rather than the interests of the purchasers, and he was afraid some of these conditions were obviously unjust. The present was scarcely the time to talk much about the matter. To-day the purchaser was very glad to get practically what was offered to him, but he hoped that when the war was over there would be a better feeling between the purchaser and the manufacturer, and that they would all be able to agree upon some standard conditions, or, at any rate, upon some broad conditions. Those which the Institution had printed were a considerable improvement on the previous conditions, but they might be still further improved. What was wanted was some reasonable compromise between the two extremes of the purchaser's point of view and the manufacturer's. An important point about specifications was the necessity of putting on record all essentials. That was the first object. Nowadays there were a number of details for which there were standard specifications, and if these were proper and applicable they should be embodied, and in that case the particular specification in question would only deal with modifications of the standard. There was a third class of data which one often liked to get into a specification, and that was a record of the practice to be adopted in regard to the building of the machine. The purchaser desired to bind the maker of the machine to adopt a particular method of construction, because it was very valuable for the person who had to operate the machinery afterwards to know just how certain things had been done. In building work, there was often a question in regard to the specialists' work, whether the man's contractor was the builder or the specialist, or whether the purchaser was to make two contracts, one for the specialist and one for the builder. In the case of reinforced concrete work, at the present time the specialist in reinforcement was also a merchant of steel. Would they, therefore, make him the principal contractor and the builder the sub-contractor? If so, that had obvious disadvantages. On the other hand, if they made the builder the principal contractor, the specialist might find that he was put in rather a difficult position. With regard to coal specifications, he was not a believer in calorific value. The figures of moisture and ash and small coal were all excellent, but he thought that in practice one found that whatever figure one got in the calorimeter it did not indicate fully the value of the coal to the user. In the case of a coal which was very dirty—with, say, 50 per cent. of ash—on the ordinary mechanical stoker the coal would be unburnable, so that the value of the coal depended on the amount which was combustible, and as the ash increased the value of the coal decreased still more rapidly. The question of coal was very complex, and they wanted to know a great deal more about it. Though the existence of a certain amount of water in coal when it had

been fired was in many cases extremely valuable, they did not want to buy water at coal prices. Some very interesting results had been published of the mixing of lime with coal to get more heat out of it, and he thought there was something in that.

Mr. Campion asked as to the practice with regard to the penalty clause, observing that when he was seeking to apply it he was told that it was never done. He wished to know how many coal merchants were found willing to tender to the coal specification. He agreed with the author that the Yorkshire coal destroyed the brickwork a good deal.

Mr. Jewell said that in working under such specifications as the author had described there must be a great advantage in having a full bill of quantities, especially in regard to the settling up afterwards. Congratulating the author upon the results of his work in connection with the electrification of the L.C.C. tramways, he expressed his particular satisfaction that only £1,500 had been spent abroad, and said this set a great example to other corporations.

Mr. Lang said his idea of the real purpose of a specification was that in the first place it was intended to enable them to avoid litigation, and in the second place to provide the seller with a guide as to what he would be called upon to do. He doubted very much whether these purposes were being served by the specifications of to-day. He thought it would be well if the engineering profession would take a leaf from the book of Lloyds, who would draw up on half a sheet of notepaper a specification for insuring property to almost any amount against fire.

Mr. Shepherd, in reply, said with regard to the point raised by Mr. Woodhouse as to what was a model specification, he once asked that question of a very experienced gentleman, who said that, from the point of view of the purchaser, the best specification he had ever seen was written on the back of an old envelope, and said, "Wanted, a steamer for the Derry trade." The effect of that, said his friend, was that if the hinges on the doors were not right, or the colour of the paint was not what he had expected it to be, he could hold that the steamer was not what he had wanted, and was not suitable for the Derry trade. He had not declared that the specifications that he had put before them were the ideal, but only that they were specifications that one had had to work under for a number of years because the tenders were always advertised for, and the lowest tender always had to be accepted. He could not confine the competition to a few well-known firms, as Mr. Lang suggested, but had, in one case, actually to accept a tender from a firm absolutely unknown, and which had never done any work of such magnitude as that for which it had tendered. The tender of that firm was for less than half the highest price of the others, and yet the work was done right. With regard to the arguments about the calorific value of coal, he had taken some pains to indicate the difference between what one might do when a free agent, and what had to be done in the conditions in which he was placed at the time referred to. He had had to buy from any merchant in London who would put in a satisfactory price, because he had no other course open to him when he had to be responsible for running a station of such a size that it turned out annually as many units as were used, both for lighting and tramways, by both Liverpool and Glasgow put together. With regard to the point that such long specifications must involve a lot of legal disputes, that had not been his experience. There would be some 200 contracts to carry out all the works for the electrification of the tramways of London, and out of all these only one legal question arose, and in that case the parties amicably agreed to refer the matter to an arbitrator. As to the penalties, he agreed that it was one of the most difficult things to obtain penalties under a specification, especially for a public body. They had one contract for the supply of goods to be delivered in six months, and no portion of them was in fact delivered in nine months. The contract was for £14,000. In consequence of the delay, 22 miles of tramways lay idle for three months at a loss of revenue of £50,000. In that one case the full penalty of £13,000 was exacted. In order to get the penalty it was certainly necessary to be able to prove that there had been loss to at least an amount corresponding to the amount of the penalty. Reverting to the coal question, he had been asked from how many merchants in London they got tenders. The reply was from practically all. In Yorkshire, no doubt, they could deal directly with the colliery proprietors, but the colliery proprietors would not tender to a calorific value; the coal merchants of London were more enterprising, and they got the coal from many sources and blended it so as to extract as big a bonus as they could. This method gave an incentive to the coal merchants to buy as cheaply as possible. During a period when his authority had to buy from hand to mouth at spot prices, the calorific value varied from 11,000 B.TH.U. to 14,500 B.TH.U., the ash varied from 5 per cent. to 35 per cent. The variation in quality was far wider than any variation in price. In answer to Mr. Jewell, he would say that he did not see how it would be possible to make up a tender without a bill of quantities. The main item of the specification was the bill of quantities, and the variation from the quantities would be excessive if it was more than 10 per cent. plus or minus. With regard to another question, he did not want to be dogmatic, but he preferred mica before everything else, and wherever he used mica he had it thoroughly impregnated. If they were using high-tension winding without such impregnation they were simply asking for trouble. Even with low-tension they should impregnate, fill up all air spaces, and keep out all moisture. As he had indicated, now that he was not a public official, but a free agent, he could please himself about his manner of buying. A well-known cable maker once said to him, "I buy nothing by specification, and buy mostly on the telephone, but I sell nothing at all on the telephone, and wholly by specification," and specification of some kind was necessary to define what the purchaser was buying and what the other man was supposed to be selling.

REVIEWS.

Telegraphy. By T. E. Herbert. London: Whittaker & Co. Price 9s. net.

To those connected in any way with telegraphy, it were almost sufficient to say: "The third edition of Herbert's 'Telegraphy' is ready"; whilst to others singularly unfortunate or immature, one might explain that this book is a detailed exposition of the telegraph system of the British Post Office, and enough would be said. However, a volume of this size, representing so much labour and skill by author and publishers alike, and offered at such a remarkably moderate price, deserves more than passing mention. The purpose of the work is still to provide an up-to-date and detailed treatment of the telegraph equipment and practice of the British Post Office, and also to cover the field of Post Office and City Guilds' examinations in telegraphy. During the ten years which have passed since this book first appeared there have been many advances in the ways and means of telegraphy, particularly in the field of high-speed telegraphy, to which the author has devoted much space and care. Quite a large proportion of the book has been rewritten or rearranged, and for this reason, if for no other, it is well to outline the arrangement and scope of the enlarged work as it now appears.

That a considerable amount of elementary matter is included goes without saying, but it is presented clearly, concisely, and in a manner which is in keeping with the whole scope and nature of the book and the needs of readers. "Advanced" matter is also included as regards the construction of apparatus and the working of systems, but there is a complete absence of mathematics other than the simple calculations with which the student must be made familiar. An ample number of numerical examples is included in the text. The first chapter is concerned with primary cells, which are of great importance in telegraph practice. The improved Leclanche cell is now used by the Post Office to the exclusion of all other primary cells, and the work done by J. G. Lucas in this connection is not so well known as it might be. A long chapter is devoted to calculations in connection with circuits and conductors—the arrangement of cells, joint resistance, and division of current, resistance of wires of various dimensions, electro-magnet problems, &c. The author deals correctly with the method in which cells should be joined up under different circumstances, the distinction between the correct basis and one which was formerly given general acceptance having been exposed in great detail by Dunton. About 100 pages are devoted to ways and means of measuring current, E.M.F., and resistance as practised by the Post Office, and these chapters embody matter which should be valuable to every electrical student, and not merely to him who is to specialise in telegraphy. The present-day equipment of the Post Office in the way of measuring instruments is worthy of the work which has to be done, and every year sees some improvement in the interests of efficiency. The old "Q. and I." detector is almost as obsolete as the terms which gave it its cryptic name.

Chapters VI to XV deal with the principles, construction, and use of the apparatus employed by various telegraph systems, viz.: single-current systems, the double-current system, the differential and bridge duplex systems, the quadruplex, and various high-speed systems. A long chapter is devoted to the Wheatstone automatic system, which, thanks to keyboard perforators and receiving perforators, remains a formidable competitor amongst those systems which have been developed to meet modern traffic conditions on trunk lines. The Wheatstone A.B.C., the Steljes recorder, the Rebesi typewriting telegraph, and the Hughes system are dealt with, and then come chapters dealing with what the author terms "the outstanding feature of the past ten years," viz., the development of the Baudot by Major A. C. Booth, and the introduction of the Murray multiplex. The Baudot sextuple duplex system, giving 12 channels over a single wire, is now in daily use in this country. The Murray multiplex has been developed specially to work in conjunction with the Baudot multiplex, of which there are about 400 circuits in existence. The explanation of these complex systems, or, rather, of the complex apparatus which they employ, is by no means a simple task, but it is one which the author has accomplished very creditably. The excellent line illustrations are a great assistance to him and to the reader alike. In a few cases the lettering is painfully small, but never actually illegible.

The central-battery telegraph, invented by C. J. Mercer,

is now in extensive use, and in Chapter XVI the author describes various central-battery duplex systems and telegraph switching systems. The construction and use (in telegraphy) of secondary cells are next dealt with, an important section being devoted to alterations in circuit connections for universal battery working. Successive chapters treat of repeaters, the test box, protective devices (against fire, lightning, and power circuits) and telegraph testing, and the formation of special circuits. The sections of the chapter on testing deal with the morning test (for which a Megger is now used in place of the Eden test), fault localisation, resistance tests, underground cable tests, tests for fault position and resistance of earth connection; tracing instrument faults, and the making of good or faulty circuits. The last two chapters occupy nearly 150 pages, and are devoted to the construction of aerial lines and underground lines; both are well illustrated, and leave no room for criticism. Provided that it is revised from time to time, it is difficult to see how this book can ever lose the position and repute it undoubtedly holds at present. The latest edition should be in the hands of every worker and student of telegraphy.

A Treatise on the Theory of Alternating Currents, Vol. II. By Alexander Russell, M.A., D.Sc. Second edition. Cambridge: University Press. Price 15s. net.

Dr. Russell's treatise on the theory of alternating currents has long occupied the position of a standard work in regard to the subject of which it treats, and we are glad to welcome a second edition of its second volume.

Readers will remember that the first volume is devoted to alternating current phenomena and problems which are largely independent of specific forms of machinery and apparatus. The second volume deals with the working of alternating apparatus and machinery, and it thus touches problems which are more intimately connected with the occupation of the engineer; indeed, its theorems are to a large extent an analysis of the performance and properties of the machinery which the engineer has created for the service of mankind.

In the present edition a number of alterations and additions have been made in order to bring the matter up to date. Thus, several types of machinery which have become increasingly important in recent years have been introduced for the first time as illustrations of the theoretical work, *e.g.*, the La Cour motor converter, the synchronous booster, the split-pole converter, and frequency changers.

Among the portions which have been largely rewritten, the author mentions in his preface the theory of armature reaction, which he now treats according to the method suggested by Prof. Lyle, the theory of the induction motor and the theory of power transmission. The last-named subject is treated largely by means of hyperbolic trigonometry, and in order to explain the use of the hyperbolic functions employed, a new chapter on hyperbolic trigonometry has been added.

It is, perhaps, unnecessary to summarise the contents of a book which is already so well known, and it would be difficult even to attempt an adequate criticism in detail of a work involving such an enormous amount of labour as the author has bestowed on the mathematical theory contained in this volume.

The work is, in fact, an admirable exposition of the application of mathematical analysis to the performance of modern electrical machinery and appliances extending over a very wide field. Perhaps some readers will be inclined to regret that the treatment of the various problems is so much restricted to a purely mathematical analysis, and that many elegant graphical or geometrical methods of illustrating performance under various conditions, which have proved themselves of so much value in practice, have been omitted. Probably such readers would also have welcomed a more liberal introduction of curves which would help to visualise the mathematical results arrived at. Other users of the book, again, who have grown used to the simple notation for complex quantities, which has been used with such effect by Steinmetz, will perhaps think that some of the problems might have been solved with greater ease by the introduction of the symbolic notation. In the hands of the author, however, the methods of algebraic analysis appear to afford the most powerful weapons of attack, and he generally prefers to proceed by general methods to general solutions. At the same time, in some chapters he has borrowed a number of graphical solutions for those problems to which they are peculiarly adapted.

It will be gathered that the book is one which is rather to be used for reference in connection with matters of fundamental theory than of the every-day questions of behaviour or design. At the same time, the practical engineer who may be called upon to deal with difficult problems connected with electrical machinery will do well to keep it on his bookshelf for reference—always assuming that he has also provided himself with sufficient facility in higher mathematics to enable him to follow its analyses.

A useful list of references is appended to each chapter, while it is hardly necessary to say that, like the other volumes in the Cambridge Physical Series, the clearness and excellence of production of the volume leave nothing to be desired.

Les Surtensions dans les Distributions d'Energie Eléctrique. By I. van Dam. Paris: Librairie Gauthier. Price 12f. 50c.

We have in the work now under review a comprehensive treatise on high potentials superimposed upon electrical distributing systems, and consequently upon machinery and apparatus, due to resonance, to atmospheric action, to harmonics in alternator waves, to the electrical state of the installations, or other causes.

As a book, it is well printed, but bound in the inadequate fashion characteristic of French literature, even when technical and of permanent value.

The first chapter deals with "potential explosif," or breakdown voltage, and starts with air. Tables are given showing the sparking distances between spheres, points, and plates, obtained by different experimenters.

The next chapter treats of corona discharge, with more tables, and formulæ for calculating the strength of the electrostatic field produced by different voltages.

In Chapter III different forms of insulators for overhead transmission are considered, and to those who are familiar with the latest American publications there is little here that is new.

Chapter IV discusses self-induction and capacity in overhead and underground lines, and the usual formulæ for calculating these quantities are given, with substituted condensers in three-phase conductors, and all the considerations with which the aforesaid American publications have made us so familiar.

Harmonics in the alternator wave are investigated in the fifth chapter, and, properly studied, it leaves little uncertainty in the student's mind.

A consideration of resonance forms the subject-matter of Chapter VI, and the formulæ required are given, with practical examples from American and other practice. Resonance may be due to an accidental earth, and the causes of resonance and means of preventing trouble are considered. So far as preventive means are concerned, the author at once informs us that there is no apparatus which will prevent "surtensions" due to the equality of the periods of oscillation of the network and of the source. General counsels are given—do not put on a feeder before the machine is up to speed and full voltage; do not use concentric cables on extended networks; choose a generator the wave of which does not contain harmonics likely to be troublesome; make oscillographic investigations; and so on and so forth.

Chapter VII tells us of the rise in pressure at the end of long lines without load, which was first noticed on the famous Ferranti mains from Deptford to the West End, we forget how many years ago.

Variations in the electrical state of the installation give rise to "surtensions" (we rather like this word), and Chapter VIII goes carefully into this matter. Some examples are given taken from the 30,000-volt network of the Berliner Electricitätswerke, and the Deptford case is mentioned, together with the old original station of the Westminster Electric Supply Corporation at Horseferry Road. Variations on any system can be caused by switching in or out of circuit a transformer, or an aerial conductor, or by the sudden rupture of a short circuit. Protective devices find a place in this chapter.

The ninth chapter deals with atmospheric effects, and the tenth with lightning arresters, and the different forms of resistances used with such apparatus. Again, practical cases are given, including some occurring in Norwegian practice.

Earthing is considered in Chapter XI, and contact between high-tension and low-tension lines in Chapter XII.

The thirteenth, and last, chapter gives specifications for cables and machinery according to French, German, British, and American practice.

The book is clearly the work of one who has specialised in his subject, and as such it should form a valuable textbook to those who wish to do the like, and a very useful work of reference to those who, while lacking time and opportunity for specialisation, desire to keep in touch with the fundamentals of the subject.

Mechanical Drafting. By C. B. Howe. London: Chapman and Hall, Ltd. Price 7s. 6d. net.

This work is intended to assist the student to a knowledge of the principles of mechanical drawing and their practical applications, and, as its title indicates, is based upon American practice; but the draughtsman's art is an international language in itself, and as the text is not obtrusively "United States," the book should be very useful to British readers. One of its best features is the profusion of drawings and sketches of apparatus, materials, and methods of use, so clearly outlined and so detailed as to speak eloquently for themselves; but this is not made an excuse for slurring over the descriptive matter, which is equally lucid and explicit. As an example of the former, we may cite a *half-tone* reproduction of a pencil drawing, showing, as no other method could show, the faint outlines of the details at the commencement, and the strengthening of the lines as the drawing proceeds, as well as the method of laying out the centre lines and commencing the design. Another figure shows the proper order to follow in inking the lines or making a tracing, in five stages. After fully treating of the manual operations involved, the author discusses the geometry of

drawing, and inculcates the system according to which the plan is placed above the elevation of an object. The curves of intersection of surfaces of various shapes are well illustrated, and the development of surfaces is dealt with at some length. The technique of working drawings is then discussed in detail, with very numerous examples of parts of machines. Architectural and building plans occupy a good deal of space, and here valuable aid is afforded by half-tone illustrations, showing the final appearance of the details drawn. Plotting surveys and map drawing, with the use of surveying instruments, is followed by a chapter on pictorial representation and sketching, and the last chapter deals with blue printing, with illustrations printed in colours. Altogether it is an excellent work of its kind, which we can cordially recommend to the engineering draughtsman who desires to perfect himself in his art.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TRANSIT OF GOODS THROUGH FRANCE.—The official *Board of Trade Journal* for January 11th publishes a full statement of the regulations now in force respecting the transit through France of goods sent from the United Kingdom to Switzerland, Italy, and Spain *viâ* France. Firms interested should consult the *Journal*, or they can obtain full information from the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

MOZAMBIQUE.—A revised Customs Tariff for the territories of the Province of Mozambique which are under the direct administration of the State has recently been promulgated, containing new schedules of import and export duties. Among the former may be noted the following:—

RATE OF IMPORT DUTY.

	In the districts of Lourenço Marques, Inhambane and Mozambique.	In the districts of Quelimane and Tete.
Lead in bars, sheets, or plates, unwrought	3% *ad val.*	3% *ad val.*
Copper (pure), bronze, brass and similar alloys in bars, sheets, or plates, unwrought	3% „	3% „
Transmission belts for machines	1% „	Free
Engine and boiler packing of rubber, asbestos, or any other substance	1% „	Free
Tin in bars, rods, granulated, and in powder	3% „	3% *ad val.*
Fuses	3% „	3% „
Metal wire covered with rubber, with any textile, or with paper	10% „	10% „
Wire, plain	3% „	10% „
Books, catalogues, newspapers, &c.	Free	Free
Printed matter, not bound (includes printed matter in loose sheets, unpaged pamphlets, &c.)	10% *ad val.*	10% *ad val.*
Machines, apparatus and instruments for use in industry, agriculture and mining and accessories therefor	1% „	Free
Telegraph material (apparatus, &c.)	3% „	3% *ad val.*
Metals, not specially mentioned, in the rough	Free	Free
Metals, not specially mentioned, manufactured	10% *ad val.*	10% *ad val.*
Motors for use in industry, agriculture and mining	1% „	Free
Zinc in bars, plates or sheets, not worked	3% „	10% „

The new schedule of export duties comprises the following among others:—

	Rate of export duty.
Rubber—	
(*a*) Extracted by boiling	20% *ad val.*
(*b*) Extracted by boiling and by modern processes and modern crushing machinery	8% „
(*c*) Extracted by means of incision—impure	8% „
(*d*) „ „ „ pure	3% „
Goods of kinds admitted free of Customs duty, when exported	2% „
Ores produced in the province	Free

BRITISH DOMINIONS AND POSSESSIONS.—Complete lists of the articles which are prohibited to be exported to various destinations from British India, Canada, New Zealand, South Africa, Newfoundland, Egypt, Malta, Cyprus, Mauritius, Ceylon, Straits Settlements, Hong-Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana, have been issued as Supplements to the *Board of Trade Journal* for January 18th and 25th. The information in these Supplements supersedes that given in the Supplements issued on October 12th and 26th respectively. Copies of the Supplements may be obtained, price 3d. each (post free 4d.), from H.M. Stationery Office, Imperial House, Kingsway, W.C.

SWEDEN.—The exportation of electricity meters and other electrical measuring instruments, and parts thereof, has been prohibited from December 31st last, and of purple ore containing three-tenths per cent. of nickel from January 14th.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

2,082. "Process for manufacture of thin metallic tubes." S. O. Cowper-Coles. February 12th.
2,083. "Process for removal of zinc from scrap galvanised iron." S. O. Cowper-Coles. February 12th.
2,084. "Process for recovery of tin from tinned iron scrap, &c." S. O. Cowper-Coles. February 12th.
2,085. "Removal of enamel from enamelled articles." S. O. Cowper-Coles. February 12th.
2,092. "Electrical generating apparatus." J. Thompson & R. J. Thompson. February 12th.
2,093. "Wireless telegraph apparatus." J. Thompson & R. J. Thompson. February 12th.
2,098. "Frames or casings of alternating-current electrical apparatus." F. Coates, J. Mirrey and A. Reyrolle & Co. February 12th.
2,103. "Electromagnetic brake." H. V. James. February 12th.
2,106. "Device for testing magnetos and sparking plugs." E. Morgan. February 12th.
2,133. "Device for supporting shades or reflectors upon incandescent electric lamps, and for locking lamp to holder." W. Waller. February 13th.
2,157. "Electrically-driven cranes, &c." J. Bentley & W. H. Scott. February 13th.
2,158. "Continuous-current measuring apparatus." Allgemeine Elektricitats Ges. February 13th. (Germany, June 24th, 1914.)
2,159. "Wireless telegraphy and telephony." I. Hortik. February 13th.
2,161. "Insulation of electric machinery, &c." C. J. Baker & C. H. Klyne. February 13th.
2,162. "Electric heaters." A. F. Berry. February 13th.
2,179. "Electric torch." S. D. Williams. February 14th.
2,191. "Automatic circuit breakers." E. D. Rodway & Switchgear and Cowans, Ltd. February 14th.
2,194. "Wireless telegraphy and telephony." I. Hortik. February 14th.
2,214. "Continuous-current dynamo-electric machines." R. Boin. February 14th.
2,219. "Electric speed indicators." R. Bosch (firm of). February 14th. (Germany, February 26th, 1916.)
2,228. "Method of manufacturing metal felloes with upturned electrically-welded flanges." R. Kronenberg. February 14th.
2,268. "Electromagnetic switches." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 15th.
2,269. "Dynamo-electric machines." British Thomson-Houston Co. and A. A. Pollock. February 15th.
2,280. "Manufacture of electric signalling, &c., lamps." H. E. F. Goold-Adams, G. S. Hague & O. Lucas. February 15th.
2,281. "Method of mounting cams in magnetos." E. J. J. Salmson. February 15th.
2,294. "Electrical signalling system." Sir G. T. Buckham & Sir A. T. Dawson. February 15th.
2,296. "Telegraph apparatus." Indo-European Telegraph Co. & A. H. Morse. February 15th.
2,320. "Electric switch." W. A. Clark, H. G. Longford, W. W. Longford & The Sphinx Manufacturing Co. February 16th.
2,332. "Sealing and bonding glands for electrical junction boxes." G. S. Boothroyd and Callender's Cable & Construction Co. February 16th.
2,333. "Tapping-keys or switches for electric signalling systems." R. F. Rowe. February 16th.
2,340. "Process for joining-up electric, &c., wires." Slot & Zwijnenberg and J. H. van Viersen. February 16th.
2,368. "Accumulator cells." W. H. Exley. February 17th.
2,382. "Sparking plugs for internal-combustion engines." W. Entwistle. February 17th.
2,386. "Magneto-electric machines." British Thomson-Houston Co. and A. P. Young. February 17th.
2,398. "Manufacture of multi-cell batteries." A. V. St. Armande. February 17th.

PUBLISHED SPECIFICATIONS.

1915.

9,523. Electrical Water Heater. J. H. Robinson. June 30th. (December 30th, 1915.)
16,602. Electric Furnaces. F. Cochlovius. November 24th. (November 24th, 1914.) November 24th.

1916.

The numbers in brackets are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1,036. Signalling Lamp. W. T. Coulson & Optalyte, Ltd. January 22nd, 1916. [103,498.]
1,038. Electric Lampholders and the like. J. C. White. January 22nd, 1916. [103,499.]
1,098. Automatic or Semi-automatic Telephone Systems. Relay Automatic Telephone Co. & T. M. Inman. January 24th, 1916. [103,508.]
1,299. Galleries for Gas and Electric Fittings. T. Cracknell. January 27th, 1916. (Cognate application, 10,563/16.) [103,518.]
1,469. Electrical Selectors or Impulse Responders. Relay Automatic Telephone Co. & L. C. Bygrave. January 31st, 1916. [103,524.] (Addition to 9,345/15.)
1,530. Indicating Apparatus to Assist in Teaching Accurate Shooting at a Target. C. W. Wedgwood. February 1st, 1916. [103,527.]
1,584. Magnetic Compasses. S. G. Starling, A. J. Hughes & H. Hughes and Son. February 2nd, 1916. [103,530.]
1,595. Transmission of Wireless Signals. R. C. Galletti and Galletti's Wireless Telegraph & Telephone Co. February 2nd, 1916. [102,400.]
2,681. Terminals for Electrical Machinery and Appliances. F. J. Hadfield. February 23rd, 1916. [103,545.]
2,895. Telephone Transmitters. E. A. Petithory. February 26th, 1916. [103,549.]
4,319. Self-controlled Aerial Machine embracing a Torpedo and sustaining means therefor. F. W. Buck. March 23rd, 1916. [103,557.]
4,343. Means for Controlling the Electric Lighting of Motor Vehicles. W. Curtis. March 23rd, 1916. [103,558.]
10,101. Protective Relays for Electric Circuits. British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). July 18th, 1916. [103,609.]
12,406. Safety-controlling Gear for Electrically-propelled Vehicles. F. Garrett & H. K. Pratt. September 1st, 1916. [103,617.]
12,517. Dry Batteries. A. H. Sheppard & British Ever-Ready Co. September 4th, 1916. [103,618.]

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254. Process of Electric Welding. T. E. Murray. February 18th, 1916. [103,636.]